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Editorial Notes

Our Third Institution Number

THIS issue of the "JOURNAL," containing as it does the whole of the written contributions to the June Institution Meeting discussions, and the authors' written replies to them, completes our record of the proceedings, and constitutes a Third Institution Number. Our first two Institution Numbers were dated May 30 and June 13 respectively.

Time was, and not so very long ago, when we were able to present to our readers one comprehensive issue covering the whole transactions of the Institution for one year. But to such an extent have the proceedings grown that the June Meeting alone has now to be spread over three issues, in addition to which there are the Autumn Research proceedings to report later in the year.

The written contributions to the discussions, which are given in full in the present issue, and which it cannot be denied make most interesting reading, are only shorter by less than one-third of the whole of the spoken discussions, a complete report of which was given in our second Institution Number. It is particularly noteworthy that leaders of the Gas Industry in America are among the contributors to the discussion on Mr. Carmichael's paper.

Whither Amalgamation?

THIS is a question to which a great number of people interested in the Gas Industry would like an answer at the present moment. It is a question which is being put to us on many occasions, and frequently not without grave concern by those whose views on gas matters we have every reason to respect. It is a leading topic in these days whenever gas men meet, whether few or many, and was certainly one of the chief subjects of informal discussion at the Institution Meeting. Although it is a matter which, in our view, requires fresh air, it is not one upon which a formal discussion would have shed much daylight, even if it was considered a proper matter for Institution discussion. Those who are actively engaged in promoting groups are unwilling, for obvious reasons of their own, to say much until they are quite ready to announce the now familiar "so much for every £100 of stock." Those who, on the other hand, are not altogether satisfied in their own minds that everything is for the best are in many cases for equally obvious reasons unwilling to say much—in the open. They feel that at any moment their turn may come, and, if they are to start again as mere units in a large, comprehensive group, they do not intend to risk the possible handicap of beginning as avowed anti-amalgamators.

We wish to make it quite clear at this stage that we ourselves are by no means avowed anti-amalgamators as far as the Gas Industry is concerned, though we must confess that one of our most difficult tasks in recent years has been to turn away the very insistent arguments of various trade periodical groups which have offered us seemingly attractive stabling along with papers, many of quite uncertain origin, serving every conceivable industry—including the electrical. We have on occasions had reason to be more than thankful afterwards that we have maintained an independence on behalf of the Gas Industry, but far be it from us to imply that the grouping of gas undertakings, so far as it has gone, will not turn out successfully. The names of some of our most able administrators appearing on the various Boards should inspire confidence in this direction. While they remain we should have no qualms, and we personally do not intend to contemplate the future visualized by those who see in the present grouping merely a clearing away of preliminary obstacles ready for the next invasion of American capital. We merely state this as a view that is held, and leave it there for the time being.

Rumour and Unrest

BUT it is idle to overlook the fact that what is going on at present is causing in many quarters a feeling of unrest and unsettlement, almost of suspicion, which is not good. One man asks another how it can possibly be of benefit to the Industry that a financial group should offer to buy existing gas stock at fifty per cent. premium. They both agree that the Industry has never had any difficulty in raising money direct from the public on good terms, and not being themselves financiers they decide therefore that a low capitalized undertaking will be overloaded, and that the whole affair is a financial ramp engineered with the object of finding fat jobs for directors. This is another view which we have had quite seriously put before us, and we are inclined to think that it is the methods of procedure rather than the object in view which are giving rise to such suspicions. "Point me out Mr. So-and-So" was a request we received at a gathering during the Institution Meeting. The reason given for this desire was that Mr. So-and-So was paying sudden and totally unexpected visits upon gas undertakings to discuss amalgamation with unprepared managers, and our interrogator wanted to be ready for him. Again, we are asked if we know anything of a firm of stockbrokers who write and ask for a gas company's last balance sheet, and, if certain details are not given on it, may these please be supplied in addition for the benefit of potential investors. And the story goes that a general

offer for the shares follows shortly after. We emphasize the words " the story goes," because we quote these little incidents as typical of the kind of gossip which is going round, and it is easy to see that they are readily magnified into suspicious circumstances by those who can obtain no clear picture of what is going on.

We fully realize that in so far as the grouping movement in the Gas Industry is its reply to the electrical grid, its way cannot, even if we wished it so, be made smooth by Government guaranteed loans, and that therefore private finance must somewhere enter into the deal. We could have wished, all the same, that some national body, as, for instance, the National Gas Council, could have acted as controlling and co-ordinating authority in the matter, but we realize that they are not a financial house, and that the machinery of amalgamation is outside their sphere. At the same time, the Council have openly advocated the *policy* of grouping, and, even if they cannot answer our question, " Whither amalgamation? " we, and we know that many others, would welcome an assurance from them that the present trend is, in their opinion, in the direction of the Industry's best interests.

N.G.C. Policy

LET us turn to the Council's last statement of policy on the subject, and quote Sir David Milne-Watson, speaking as its President at the Annual Meeting in May. " However willing, or, indeed, eager, undertakings may be to adopt the policy outlined, yet there are still a large number of the smaller undertakings which are not in a position to give effect to it for the following reasons. It is too often the case, even where the carbonizing operations are efficiently conducted, that they have not the resources or facilities, personnel or knowledge, to meet the increasingly exacting requirements of the present-day gas consumer. Frankly, such undertakings cannot—at any rate, if their future is taken into account —be regarded as economic, and in many cases their continued existence in their present form is gravely threatened. . . . I am satisfied that it is in the best interests not only of the consumers, but of the proprietors themselves, that they should make, wherever this is possible, reasonable arrangements—and I emphasize the word reasonable—for merging their undertaking in some neighbouring undertaking or some holding company.

" On the instructions of the Central Executive Board the smaller undertakings have had the position clearly indicated to them, and though in some cases the danger has been appreciated and active steps are being taken to follow the advice tendered, there are many undertakings which up to the present have ignored the Board's suggestions. I hope that those who are still holding back will reconsider the position very seriously, not only because their failure to do so may have prejudicial repercussions upon the Industry as a whole, but will probably mean their own eventual collapse."

Since that time events have moved—and from all accounts are still moving—rapidly, and many are asking themselves whether or not it is the right direction. Whether it is in the direction indicated by the National Gas Council depends largely upon one's idea of what constitutes a " smaller undertaking." We have all along advocated the grouping, where possible, of the really small ones with an efficient and go-ahead parent to mother them. But we must confess at the moment to a certain doubt as to whether, using the age-old natural history illustration of the fleas, the main interest of the amalgamators is not tending towards those in the larger categories, while the lesser and *ad infinitum* are being considered as not too well worth bothering about.

The Oldest Gas Association

GRUMBLING profusely at the number of meetings and conferences which the gas engineer is called upon to attend in these days, more than one hundred members of the Waverley Association assembled last Friday in Edinburgh for their Annual Meeting. One soon gathered, however, that the complaints were not directed against the business on hand. On the contrary, the members of the " oldest gas association in the world," for such is their proud claim, were quite prepared to offer affiliation to any other organization, not even excluding the Institution of Gas Engineers, and their own meeting is certainly the very last one they would wish to abolish.

The meeting was admirably conducted, in a spirit which is essentially the Waverley Association's own, by a Scot who has long since crossed the border—Mr. George P. Mitchell, of Worcester. It is typical also of the Association and what might be described as its very agreeable unconventionality that Mr. Mitchell, in charge of a large English Company, is to be succeeded as President by the Engineer and Manager of a ten million works in Scotland; and a very popular choice judged by its reception at the meeting.

In the year that Mr Mitchell was born—1887—his Father was President of the North British Association, and an extract from his Presidential Address on that occasion was quoted by Mr. J. W. Napier at last week's meeting. " It requires a very slight knowledge," said Mr. Mitchell, sen., " of the modern history of gas lighting to enable one to conclude that we have advanced with giant strides; that our course is still one of progress and that, so long as the cry of managers of gas-works is Excelsior, the demand for gas will increase and the proprietors of gas-works, be they Companies or be they Corporations, will earn a handsome return for invested capital. Brilliant results, however, cannot be achieved if gas managers remain indifferent to the opinions and feelings of their customers."

Upon which Mr. Napier's very apt comment was that the extract read with strange intimacy into the views now expressed by Mr. George Mitchell in his Waverley Presidential Address 47 years after.

That First Block

IN the " JOURNAL " last week we said: " Certain attempts to introduce multiple tariffs have failed because of two reasons: The high rate for the first block and the fact that, before the consumer could obtain any relief, his consumption had to be very considerable. Even then the relief offered was too small really to attract business. The success of any multiple tariff depends, we think, in quick relief after a relatively small consumption." Apropos this, we are glad to note that Mr. Mitchell shares our view. He asks how anybody can expect to obtain business by giving minute concessions in the early part of a multiple tariff; and he rightly maintains that quantity scales would serve a very useful purpose and more nearly approach the ideal tariff if they dropped 6d., 9d., or 1s. per 1,000 c.ft. after an initial block of, say, 5,000 c.ft. per quarter. There are a few notable examples of this form of scale, and they are of the greatest assistance to the gas salesman. We suggest

that whenever any reduction in the price of gas becomes possible it should be applied not to the flat rate but to a multiple part scale which affords quick relief after a small initial block, and thus is a practical incentive to the consumer to extend his use of gas.

We are glad, too, that Mr. Mitchell sees eye to eye with us in the matter of wise spending in order to bridge the gap between the cost of gas into holder and the price which the consumer is called upon to pay. Consistently during the fearful economic and industrial depression of the past few years, when the Government were urging municipalities to curtail expenditure, we have emphasized that cheap gas and failure to maintain works and distribution plant in first-rate condition to meet present and likely future demands are incompatible. A pertinent example of wise spending is given by Mr. Mitchell. When he took over the management of the Blackburn Corporation Gas Undertaking the outstanding debt was £804 per million c.ft. sold. As a result of the war, extensions had necessarily been delayed, and Mr. Mitchell was faced with heavy expenditure on new works and on the distribution system. That was in 1919. By 1927 new works had been erected capable of meeting requirements and of taking 25% additional load. In spite of this heavy expenditure, by 1930 the debt per million c.ft. had been reduced to exactly half—£402—and the selling price of gas by 1s. 5d. per 1,000 c.ft.

Hire or Hire-Purchase?

Obviously these reductions could not have been effected without forceful and well-planned salesmanship, and an explanation of some of the methods adopted by Mr. Mitchell forms the major part of his address. We call attention to the results of the policy pursued at Blackburn—and we assume also at Worcester—of making as little price distinction as possible between the gas supplied to ordinary and prepayment consumers. When Mr. Mitchell went to Blackburn in 1919 the marginal difference was only 1d. per 1,000 c.ft., and he extended to the prepayment consumer the offer of hire-purchase terms for gas appliances over a period as long as ten years. In 1919, with an unemployment figure of 10,762 in Blackburn, the average prepayment consumption was under 12,000 c.ft. a year. In 1932, with nearly 20,000 unemployed, the average consumption figure was over 20,000 c.ft. "The proof of the pudding . . ." In common with Mr. Mitchell we strongly favour hire-purchase in that consumers feel that in this way they are capitalizing their savings by purchasing something from which they obtain a fair return. He suggests to those who have apparatus out on the simple hire system that every endeavour should be made to consolidate their position by offering for a small cash payment the appliance now in use, or a better appliance at a sightly increased amount on hire-purchase terms.

Mr. Mitchell abandoned simple hire at Blackburn in 1920, and the results of his plan are admittedly good. But we would like him to explain how he would deal with those consumers who ten years ago signed a hire-purchase agreement for an ugly black cooker without thermostatic control and have just paid the final instalment. The cooker is at long last the property of the consumer, but it is an appliance not at all in keeping with modern gas equipment with its shining enamel and oven heat control. The same thing applies, of course, to other gas appliances. There is simply no comparison between the finish of gas apparatus of to-day and that supplied ten years ago. Will the consumer who has purchased the black cooker be satisfied with the deal when the electrical salesman comes along with his attractive appliances on low simple hire rates? Or will the gas salesman point out to the consumer that his gas cooker is now hopelessly out of date, and that, having bought it, he ought really to scrap it? There is another point. The population in different areas varies—in some it is practically stationary, in others "floating." Where there is a large percentage of floating population, simple hire may mean gas usage which could not be gained by insisting on hire-purchase.

Obsolete Appliances

Unquestionably we must face the fact that obsolete apparatus must be removed from the district. "Ruthless scrapping may appear at the time to be expensive, but it will undoubtedly repay handsomely those who undertake it boldly." We quote from the address of Sir David Milne-Watson at this year's meeting of the National Gas Council. Mr. Mitchell realizes the need for wise spending in this direction and exhorts undertakings to screw their courage to sticking-point. Hire or hire purchase remains a complex question, and the advocates of simple hire are difficult to answer when they question whether those who abandoned the system, say, ten years ago are to-day in a better position as regards replacement of black cookers. Admittedly they, as gas undertakings, do not actually own obsolete cookers on the district, but their consumers do, which is perhaps worse. So we cannot agree with Mr. Mitchell that simple hire should be given up in *all* circumstances. On the other hand, those who decide that in their own circumstances simple hire must go will do well to take courage from Mr. Mitchell's example at Blackburn, where he carried his scheme in face of opposition of all kinds, with the results shown in his address.

Discussing service after sales, Mr. Mitchell very rightly maintains that such service should be extended to coke as well as to gas. We must increase our efforts not only in preparing good coke, but in selling it. Of course, care in preparation goes a long way. In to-day's "Journal" we refer to a new installation of carbonizing plant at the Neath Gas-Works. In connection with this plant a new type of coke screen was erected, and we feel sure that our description of this screen will be of interest. We may mention here that since this screen was brought into operation on Dec. 1, 1933, the domestic coke sales have nearly doubled. On another matter, too, we are in full agreement with Mr. Mitchell—that it would be wise spending to remove a greater amount of sulphur compounds from gas than we do generally to-day. On several occasions we have pointed out that this question is a vital one which should be thoroughly investigated.

The Ammonia Situation

When the market for ammonium sulphate began to decline we emphasized in these columns that a solution to the problem lay in the treatment of concentrated liquor at central works operating on a large scale. The case for concentration followed by working up at central works has gained ground, particularly in the South of England, where quite a number of concentration plants have been erected or are in course of erection. The process of rationalization of the production of bye-product ammonium salts has also commenced in Scotland, and there are grounds for the belief that it will extend. The present position is admirably summed-up by the Chief Inspectors in their Annual Report for 1933 on Alkali, &c., Works, just published by H.M. Stationery Office. Several efficient and economical concentration plants are now available, and this method still appeals

to us as the best for the disposal of ammoniacal liquor. A more general adoption of this plan, states Dr. Damon, Chief Alkali Inspector for England and Wales, " is hindered on account of the capital outlay required, the fear of possible financial loss, and the prevalence of simple if somewhat injudicious alternative means of disposal."

There is a tendency in the Gas Industry, as Dr. Damon says, to regard ammonia recovery as a dead letter, not to be attempted as long as any means are available for otherwise disposing of the crude liquor. " In determining whether or not recovery will pay, a great many points have to be taken into consideration, including factors of loss of markets, absorption of labour, and disposal of spent oxide, which are vital to the issue. Now that the selling price of sulphate of ammonia has risen to £7 per ton, the larger companies should show a profit even with the most rigorous accountancy, while in the case of the smaller works a truly comprehensive survey would often show that the manufacture of sulphate or concentrated liquor is a more economical way of disposing of ammoniacal liquors than the wasteful methods so much in vogue." Though the price of ammonium sulphate has increased, the increase is, to our mind, insufficient to permit the re-starting of the small sulphate plant. We doubt, in fact, whether many of the small plants will ever be able to produce the salt economically. Concentration of liquor is quite a different proposition.

For works favourably placed as regards disposal of ammoniacal liquor via the sewage works, concentration plant may at the moment have little or no attraction. In certain circumstances the whole of the liquor can be discharged into the town sewerage system without trouble provided that adequate storage facilities are arranged at the gas-works, care is taken to ensure a minimum toxicity of the liquor by early separation of tar and liquor, and due regard is had to a regulated, properly proportioned flow of diluted liquor to the sewer. There is testimony that, under certain conditions, raw liquor can be treated in this manner without placing undue strain on the sewage works. Not all undertakings, however, are so favourably circumstanced, and these should consider the installation of concentration plant. The labour charges of such plant are very low, and it is possible to prepare concentrated liquor at a cost which permits of its being sold at a profit to larger manufacturers who have available a supply of sulphuric acid. The freight charges on weak gas liquor are prohibitive, but its concentration reduces these to about one-tenth. Undertakings who are frightened of the capital cost and operating charges of concentration plant should be reassured by the experiences of Mr. Philp, of North Berwick, and Mr. McDonald, of Motherwell, already recounted in the " JOURNAL."

Points to Watch

DR. DAMON calls attention to a tendency at certain gas-works to use in the sulphate of ammonia purifiers oxide which has previously been employed for the purification of coal gas. He points out that the hydrogen sulphide content of crude coal gas is of the order of 1%, while that of saturator gases is about 20%. Moreover, the procedure in coal gas purification allows of a series of purifiers being in use, whereas at a sulphate plant it is customary to employ only one purifier at a time. A highly efficient oxide should therefore be provided for the latter purpose. On attaining a sulphur content of about 30% the absorption capacity falls rapidly and the material requires frequent revivification. Dr. Damon maintains that it is better and more economical at this stage to remove the oxide to the coal gas purifiers, where it can readily be worked up to a sulphur content of 50% or more.

Another point touched upon by Dr. Damon calls for mention. The low value of ammonia has tempted some gas managers to allow a greater slip of ammonia past the washers than formerly. This practice certainly keeps the oxide in an active condition, but it also results in an accumulation of ammonium salts in the spent oxide which is exceedingly deleterious to its subsequent use for the manufacture of sulphuric acid. It seems that there are many complaints on this score, and there is no doubt that the troubles experienced as a result of undue ammonia and tarry matter contents militate against the popularity of spent oxide as a raw material for acid manufacturing purposes. This point should be borne in mind by those responsible for the operation of gas-works plant.

On a later page of this " JOURNAL " will be found an extract from the report giving statistical information of ammonia products manufactured and tar treated in England and Wales and in Scotland during 1933. In England and Wales there has been a further decrease of 34 in the number of works registered for the manufacture of sulphate of ammonia, and there are a number which, although registered, do not operate their plants. In Scotland the gas-works sulphate production in 1933 was the lowest for twenty-five years.

" Field's Analysis "

AN article will be found in this issue of the " JOURNAL " dealing once again with the publication of " Field's Analysis." The new work forms the 65th annual issue of the Analysis, and covers the accounts for the year 1933. Attention may be directed to the point emphasized by various extracts from the figures in the Analysis as to the need for increasing the sales per consumer.

It is once more our privilege to compliment Mr. H. E. Ibbs, Chief Accountant of the Gas Light and Coke Company, who has compiled the Analysis, on the production of a further addition to the very extensive library of this work. In complimenting Mr. Ibbs, the able assistants who helped him to produce the Analysis must not be forgotten, and we would wish to extend our congratulations also to them.

Forthcoming Engagements.

July 7.—WESTERN JUNIOR ASSOCIATION.—Summer Meeting.
July 10.—N.G.C.—Meeting of Central Executive Board, 2.30 p.m.
July 12.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council Meeting, 2.30 p.m.
July 18.—B.C.G.A.—Executive Committee Meeting, 11.30 a.m.; General Committee Meeting, 2.30 p.m.
Sept. 6.—NORTH BRITISH ASSOCIATION OF GAS MANAGERS.—Annual Meeting in Inverness.
Sept. 20.—WALES AND MONMOUTHSHIRE ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—General Meeting at Porthcawl.
Sept. 24-26.—B.C.G.A.—Annual General Meeting and Conference at Sheffield.
Nov. 6 and 7.—I.G.E.—Autumn Research Meeting.

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Page 90. PITTENWEEM. T. P. J. Nicolson, S., resigned.
Page 92. STORNOWAY. J. McLusky appointed E. & M. vice A. G. Arnott.

PERSONAL

NEW APPOINTMENT AT THE B.C.G.A.

Mr. WILLIAM R. OLIVER, organizer of the successful "Adventures in Colours" at the last Ideal Home Exhibition at Olympia, has been appointed Display Officer of the British Commercial Gas Association. In this capacity he will be in charge of the Association's studio.

Mr. Oliver, who was trained at the Huddersfield Art School, first came into prominence by organizing the first classes specializing in window display held in any art school in this country.

Mr. Oliver's work with the B.C.G.A. will be to advise on window and showroom displays, as well as exhibitions.

* * *

Mr. F. H. JAMES, Managing Director of Imperial Continental Gas Association, and Mr. S. G. WOOD, Chairman of the Cheltenham and District Gas Company, have joined the Board of the Severn Valley Gas Corporation.

* * *

At their meeting on Thursday last, the Stoke-on-Trent City Council confirmed the recommendation of the Gas Committee that their Assistant Engineer, Mr. J. E. STANIER, A.M.I.Chem.E., be appointed Deputy Engineer as from July 1. Mr. Stanier was appointed to the position of Assistant Engineer to Mr. A. MacKay (the Chief Gas Engineer) last October, and had previously held the position of Deputy Engineer and Manager to the Stockport Corporation Gas Department.

* * *

At a meeting of the Senate of the University of Leeds held on June 27, the Gas Research Fellowship, provided by the Institution of Gas Engineers, was awarded, on the recommendation of the Board of Science and Technology, to Mr. H. C. MILLETT, B.Sc., the tenure of the Scholarship to date from Oct. 1, 1934. Mr. Millett entered Leeds University with a Leeds City Scholarship in 1930, and took his B.Sc. degree in 1933 with first-class honours in Gas Engineering, being awarded at the same time the Le Blanc Medal for special distinction in Applied Chemistry. During the past twelve months he has been the holder of the Smithells Scholarship from the University and of the Brotherton Research Scholarship, both of these being confined to students prosecuting research. He has been engaged, under the supervision of Prof. Cobb, in continuing research work on the influence of furnace atmosphere on the scaling of steel, taking specially as his subject the influence of sulphur compounds.

* * *

Mr. JOHN MCLUSKY, of Coatbridge, has been appointed Engineer and Manager of the Stornoway Gas Light Company, Ltd. This is the fifth gas engineering post filled by men trained in the Coatbridge Gas-Works in the last six years. The other four posts filled are at Rothesay, where Mr. T. S. Lockhart was appointed Engineer and Manager; Mr. A. Jamieson was appointed to the same position at Johnstone; at Bath, Mr. A. Tran is Assistant Engineer and Manager; and, at Hull, Mr. J. Mulholland is now Technical Assistant.

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To mark their appreciation of his interest in them during the 33 years he has been connected with the Stoke-on-Trent Gas Department, Alderman T. MITCHELL, M.B.E., of Burslem, Chairman of the City Council Gas Committee, was on Saturday last presented by the employees of the Gas Department with a long service medal and gold albert. The presentation was made on the occasion of the annual outing of the employees to Blackpool by two of the oldest workers—Mr. W. J. Owen, with 57 years' service, and Mr. W. Purcell, with over 58 years' service. The medal is inscribed, "Presented to Alderman Thomas Mitchell, M.B.E., J.P., by the employees of the City of Stoke-on-Trent Gas Department, after 33 years' service on the Gas Committee, June, 1933."

* * *

At the last meeting of the Directors of Pittenweem Gas Company a letter was read from Mr. THOMAS P. J. NICOLSON intimating his resignation as Collector and Secretary to the Company. The resignation was accepted with regret, and it was agreed to record in the minutes an appreciation of Mr. Nicolson's long and devoted service to the Company. Mr. Nicolson succeeded his late father in the position nearly 32 years ago, the latter having held the post for 26 years. Mr. Nicolson was for 20 years on the Town Council, and for the greater part of that time was a Magistrate.

* * *

Mr. ADAM TAYLOR, of Balloch, has retired after having been employed as Cashier and Collector with the Vale of Leven Gas Company for forty years.

Lichfield Offer Accepted.—Messrs. Dawnay, Day, & Co. announce that their offer to the shareholders of the Lichfield Gas Company has been accepted by a large majority of the shareholders.

Association of Public Lighting Superintendents.—The Eleventh Annual Meeting and Conference of the Association will be held in Aberdeen from Sept. 17 to Sept. 20, under the Presidency of Mr. Alexander Forbes.

Employment for 300 People has been afforded by the erection of a factory in Birmingham for the manufacture of Ryvita Crispbread. The new factory, which is in Bordesley Green Road, contains some £50,000 worth of British-made plant, and is now in full production. The ovens are entirely gas-fired and consume more gas than many towns of the size of Alcester and Pershore.

A Prominent Part was played by the Langley Mill and Heanor Gas Company in the recent Hospital Carnival at Heanor (Derbyshire). In the procession the Company secured first prize in the section for the best decorated tradesman's vehicle. Their exhibit was an imposing lighthouse surmounting a vivid imitation of a rocky shore. The inscriptions on the side of the lorry on which the entry was placed read: "Gas, the light that never fails," and "Gas will keep you off the rocks."

Close on Five Hundred School Children were awarded certificates and prizes from the Alliance and Dublin Consumers' Gas Company in connection with a gas cooking competition for which 2,939 pupils of 38 secondary, national, and technical schools entered. The successful candidates were the guests of the Company at tea in the Engineers' Hall, Dublin, when the awards were made by Mr. J. X. Murphy, the Chairman. The contest, which is an annual one, was more popular and successful this year than ever.

A Balloon Race was organized by the Kidderminster Gas Company at the recent Cookley Church Garden Fête. The Competition was well patronized, and enabled the Company to hand over an appreciable amount in cash. We understand that one balloon travelled as far as Tunbridge Wells.

University of Leeds.

The following are the results of the June Degree Examination in Gas Engineering at the University of Leeds.

Ph.D.—T. H. Blakeley, B.Sc. (Gas Research Fellow), for a thesis on "The Reactivity of Carbonized Fuels at High Temperatures.

M.Sc.—W. R. Branson, B.Sc., A.M.I.C.E., for a thesis on "The Carbonization of Weathered Coal."

R. Dally, B.Sc., for a thesis on "The Treatment of Vertical Retort Tar by Cracking."

I. J. Lane, for a thesis on "The Structure and Reactivity of Cokes made from Welsh Bituminous and Anthracite coals carbonized individually and blended."

B.Sc. (Honours) 1st Class.

N. R. Balmford, B.Sc., for a thesis on "The Action of Hot Inorganic Compounds on the Volatile Products of Coal Carbonization."

G. E. Holmes, B.Sc., for a thesis on "Studies relating to the desulphurization of flue gases."

2nd Class.

G. E. Hall, B.Sc., for a thesis on "A Study of the Ash from a pulverized-coal fired steam generator with special reference to the fusibility."

Sir Arthur Duckham Memorial Fund.

Official List of Donations from June 23 to 29.

Name and Town.	Amount. £ s. d.
East Grinstead Gas and Water Company	5 5 0
East Kent Gas Company, Ltd.	2 0 0
Henry Lockhart, Jr., New York	5 0 0
Lt.-Col. W. C. Peebles, D.S.O., T.D., D.L., Edinburgh	3 3 0
Peebles & Co., Ltd., Edinburgh	5 5 0
Whitstable Gas and Coke Company, Ltd.	4 0 0
Donations (6) paid above	£ 24 13 0
Donations (609) paid previously ...	10,309 18 8
Total Donations (615) paid	£10,334 11 8
Donations (4) promised	212 3 0
Total Donations (619) paid or promised ...	£10,546 14 8

Ammonia and Tar in 1933.

Chief Inspectors' Report on Alkali, &c., Works.

In our Editorial Columns to-day we refer to some of the findings of the Chief Inspectors of Alkali, &c., Works in their Report for 1933 (H.M. Stationery Office, price 9d. net). The following information is extracted from the report.

TABLE I.—*Ammonia Products Manufactured in England and Wales.*

[Expressed as Sulphate (25¾% NH_3)—Tons.]

From Liquor Produced in—	1933.	1932.	1931.
Gas-works	89,500	97,800	130,300
Other works (including coke ovens, iron works, producer gas, synthetic, &c.)	557,500	626,700	463,600
Total	647,000	724,500	593,900

NOTE.—Of the above total, the equivalent of 68,000 tons was manufactured as concentrated liquor, and 18,700 tons of this concentrated liquor was subsequently converted to salts which are included in the 647,000 tons above. The total quantity of salts of ammonia produced, therefore, was 579,000 tons and the net production of ammonia was 628,300 tons.

TABLE II.—*Tar Treated in England and Wales—Tons.*

Origin.	Tar Distilled.	Pitch Produced.
Gas-works	980,200	208,400
Coke ovens	462,800	156,000
Other works	38,200	15,900
Total	1,481,200	380,300

NOTE.—Of the above total quantity of tar, it is estimated that 708 900 tons were distilled for the production of pitch, the balance of 772,300 tons being treated only for the preparation of road tar, &c.

TABLE III.—*Salts of Ammonia, expressed as Sulphate, Manufactured in Scotland.*

—	1933.	1932.	1931.
	Tons.	Tons.	Tons.
Gas-works	11,205	11,657	15,467
Iron works	230	*Nil*	516
Coke ovens	3,751	4,085	4,595
Producer gas	*Nil*	*Nil*	452
Shale works	25,269	25,152	31,699
	40,455	40,894	52,729

NOTE.—748 tons were obtained as liquor ammonia, and 105 tons as ammonium chloride.

TABLE IV.—*Tar Made in Scotland.*

—	Tar Distilled. 1933.	Pitch Produced. 1933.	Tar Distilled. 1932.	Tar Distilled. 1931.
	Tons.	Tons.	Tons.	Tons.
Gas-works	137,548	36,537	131,049	147,998
Iron works	1,898	1,453	*Nil*	2,634
Coke ovens	13,089	3,058	14,277	14,268
Producer gas	408	*Nil*	186	409
	152,943	41,048	145,512	165,309

Co-Partnership Gathering at Herne Bay.

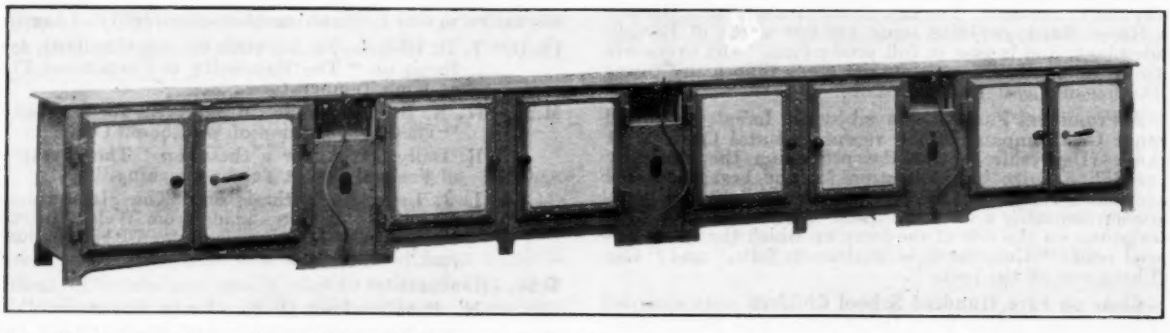
Retiring Board's Farewell.

On the evening of June 22, the whole of the Co-Partners of the Herne Bay Gas Company were present at a dinner and entertainment held in the Tudor Café, Herne Bay. The occasion marked the farewell of the retiring Chairman and Directors, who have been succeeded by a new Board on the acquisition of a controlling interest in the Company by the South-Eastern Gas Corporation, Ltd. Continuity is happily ensured in the person of Mr. Henry Woodall, who has already served as a Director of the Company for 34 years, and who will continue in office under the new regime.

The Chair was taken by Mr. Wm. A. Surridge, who in the course of a felicitous address referred in moving terms to his association with the Company over the past 50 years, and to his keen interest in the co-partnership and pension schemes inaugurated under his Chairmanship more than ten years ago.

Mr. Henry Woodall then read a letter from the new Chairman, Sir David Milne-Watson, LL.D., regretting his inability to be present and conveying his greetings to all the co-partners. He added that in welcoming them to the South-Eastern Gas Corporation he thought it might fairly be described as a "Co-Partnership of Gas Undertakings." Sir David also joined in paying a well-deserved tribute to Mr. Surridge for having so ably presided over the destinies of the Company. Mr. Woodall then presented Mr. Surridge with a handsome Georgian silver salver, at the same time expressing the wishes of everyone for the good health, happiness, and long life of Mr. Surridge.

Mr. Surridge warmly thanked the co-partners, and on the suggestion of the retiring Secretary it was resolved to send a message of welcome to Sir David Milne-Watson.



Our illustration shows a large Richmond "Bungalow" "New World" combination range which was made specially for, and is now fitted in, a large hospital. Supplied in "Rado" grey-mottled enamel finish, the complete range consists of six ovens each of which is fitted with "Regulo" control. The centre section contains four separate ovens, while there are a further two ovens (one at each end) which are fitted with double doors. The overall length of this interesting suite of ovens is 18 ft. All the special Radiation features are included, and thus each oven has a single burner, direct bottom-flue-outlet, embossed "runners," closed-in base, &c. It will be noticed that the range is equipped with three "gas matches," and is typical of the many types of large cooking appliances which are made by Richmonds for use in hospitals, hotels, public institutions, &c.

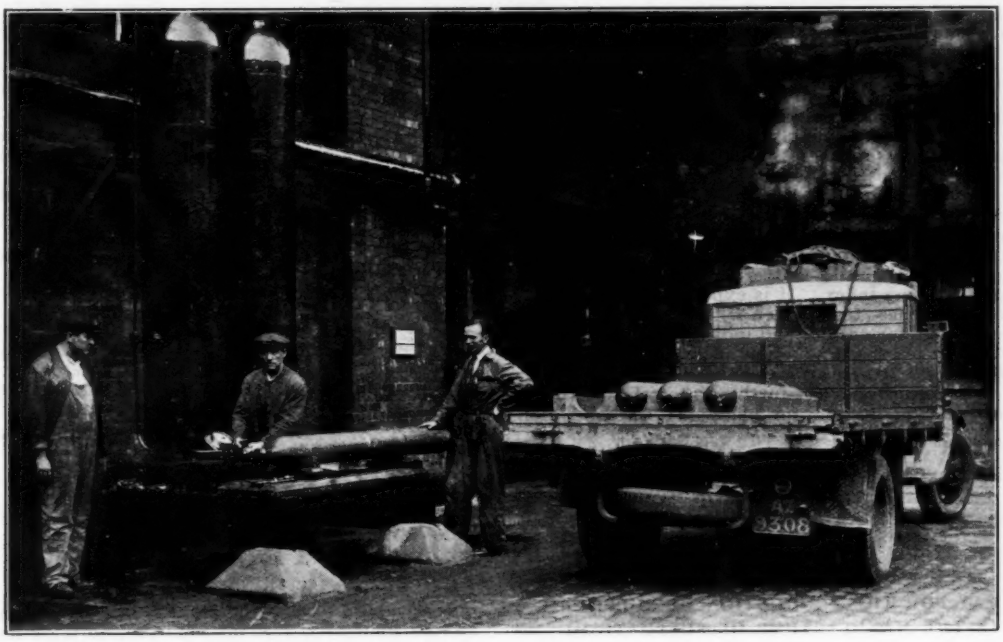
Compressed Gas for Cooking on Irish Trains.

Proposed Conversion of Motor Vehicles.

Gas compressing plant has been installed at Belfast Gas-works, and the Department is now supplying gas in special containers at high pressure. Mr. J. D. Smith, Engineer and Manager, reported to the last meeting of his Committee that the Great Northern Railway Co. (Ireland) had availed themselves of the supply of gas for use in their restaurant cars on the Belfast-Dublin route.

The Manager also reported that in many places in Great Britain gas is being used as fuel for mechanically-propelled vehicles, and he proposed to convert some of the Gas Department vehicles to use compressed gas as fuel.

In his monthly output report, Mr. Smith stated that the gas sent out from the Belfast Gas-Works from June 1 till 27 amounted to 247,916,000 c.ft., being an increase of 8,136,000 c.ft. or 3·39% compared with the two corresponding weeks last year; while the gas sent out from April 1 till June 27, 1934, amounted to 912,041,000 c.ft., an increase of 52,963,000 c.ft., or 6·16%.



FILLING THE CYLINDERS AT THE BELFAST GAS-WORKS.

R.A.F. Squadrons Use Home-Produced Fuel.

The names of the R.A.F. units detailed for the defence of London and the Midlands which are being flown on petrol produced by low-temperature carbonization from British coal were announced on June 25. Sir Philip Sassoon (Under-Secretary for Air) stated some time ago that certain squadrons would use this type of petrol.

The squadrons are: Nos. 3 and 17 Fighter Squadrons, Kenley; No. 41 Fighter Squadron, Northolt; Nos. 23 and 32 Fighter Squadrons, Biggin Hill; No. 25 Fighter Squadron, Hawkinge; "C" Flight of No. 24 Communication Squadron, Northolt.

Street Lighting and Traffic Safety.

A Departmental Committee has been set up by the Minister of Transport with the following terms of reference:

> To examine and report what steps could be taken for securing more efficient and uniform street lighting, with particular reference to the convenience and safety of traffic and with due regard to the requirements of residential and shopping areas, and to make recommendations.

The composition of the Committee is as follows:

Mr. F. C. Cook (Deputy Chief Engineer, Ministry of Transport), Chairman.
Mr. J. F. Colquhoun (Public Lighting Engineer, Sheffield).
Mr. C. A. Masterman (Chief Technical Officer, Gas Sales Department, Gas Light and Coke Company).
Major W. H. Morgan (County Engineer, Middlesex).
Mr. C. C. Paterson (Chairman of the Illumination Research Committee, Department of Scientific and Industrial Research; Director of Research Department, General Electric Company).
Mr. E. S. Perrin (Ministry of Transport).
Major L. Roseveare (Borough Engineer, Eastbourne).
Mr. J. R. Taylor (Ministry of Health).
Dr. J. W. T. Walsh (National Physical Laboratory).
The Secretary of the Committee is Dr. H. F. Gillbe.

Water Heating Push at Croydon.

During the past three months the Croydon Gas Company have been pursuing an intensive campaign for gas water heaters—especially the multi-point instantaneous type—and they tell us that the results have been most gratifying.

For three months the Company's eight showrooms have been pushing gas water heaters in their window displays, ably supported by forceful publicity in the local Press—the newspaper advertising having been planned on an extensive scale. The idea underlying this water heating push is that hot water is not a luxury, but a necessity, and that gas water heaters solve the problem of summer hot water when it is not always desired to have the coal range or the coke boiler going.

The Croydon Company's policy in regard to water heaters is, briefly, as follows: For 4s. per quarter a small heater suitable for the sink or hand basin may be installed without any fitting charge, while for 6s. a quarter, inclusive of fixing, a single-point geyser may be obtained. Larger appliances, such as the multi-point geyser, storage heaters, and circulating boilers may be all hired at rentals which include fixing. It should be noted that these figures cover maintenance service.

Behaviour of Coke in the Domestic Boiler.

Northern Coke Research Committee's Annual Report.

The annual report for 1933 of the Northern Coke Research Committee states that a domestic hot-water system incorporating a No. 1 "Ideal" domestic boiler* has now been installed in the laboratory. A number of preliminary trials of typical gas and foundry cokes were made in this boiler. The following criteria were chosen arbitrarily as a measure of the practical utility of the cokes:

(*a*) The property of burning for long periods without attention (*e.g.*, over-night, after suitable adjustment of the draught), without boiling of the water in the system.
(*b*) A low rate of consumption.

* Kindly loaned for the purpose of these tests by the National Radiator Company, Ltd., Ideal House, London, W. 1.

These criteria are independent of any considerations arising from high ash or high moisture content.

It has been found that several Durham foundry cokes, when suitably graded, make excellent fuels, on the basis of these criteria, for this type of boiler. The ½-1 in. size coke proved, in general, more satisfactory than the larger gradings. The less easily combustible cokes did not burn for sufficiently long periods without attention, when graded between 1-1½ in. sizes. The period of combustion was, in general, increased by reduction in the size of the coke. There was a distinct tendency for the order of utility of similarly graded cokes, as shown by the stove trials on the basis of the criteria stated, to be the same as the order of the C.A.B.'s† of the cokes.

Programme of Research.

Subject to the provision of sufficient funds, the Committee proposes to continue or commence, during this year, investigations concerned mainly with the utilization of coke. The following outlines three of the investigations upon which it is proposed to work:

The Correlation of the Properties of Coals with Coke Quality.—Coals or coal mixtures giving commercial cokes of known properties are being examined by the Committee's tests for the determination of plastic properties, the rate of loss of volatile matter during carbonization, and the agglutinating index. It is expected that data will be obtained from these tests which will throw light on the mechanism of coke formation, and indirectly upon the conditions necessary for the production of good quality coke.

The Effect of Carbonization Conditions upon Coke Quality.—It is hoped to collect further data relating to the effect upon coke quality of, for example: Carbonization time or rate of heating, variation in the coal size, "soaking" or over-heating, moisture content, oven width.

The Use of Coke as a Domestic Fuel.—The investigation of the factors influencing the behaviour of coke in the closed type of domestic stove or coke-fired boiler is being continued. Practical means of improving the performance of coke in the domestic coke-fired boiler are being examined. It is proposed to carry out, in collaboration with the Midland and Scottish Coke Research Committees, a correlation of the behaviour of cokes in the combustibility test devised by the Committee, and that observed in tests in the domestic grate.

† Critical minimum air blast.

Amalgamation and Grouping.

Gloucester.

The Severn Valley Gas Corporation, Ltd. (it is announced in *The Times*), has made an offer to purchase the 5% maximum consolidated ordinary stock of the Gloucester Gas Light Company. Holders of each £100 5% maximum consolidated ordinary stock of the Gloucester Company are offered (1) £120 in cash, or (2) 112 Severn Valley 4½% cumulative preference £1 shares, or (3) 50 Severn Valley 4½% cumulative preference £1 shares, together with 60 Severn Valley ordinary £1 shares.

South-Eastern Gas Corporation.

At a meeting convened for July 18 it will be proposed that the share capital of the South-Eastern Gas Corporation be increased to £2,500,000 by the creation of 500,000 new shares of £1 each. Of the new shares 250,000 will be ordinary shares and 250,000 4½% cumulative preference shares, having the same rights as the existing 1,000,000 4½% preference shares.

CONTINENTAL NOTES

A NEW WAY FOR THE PRODUCTION OF SULPHURIC ACID IN THE MANUFACTURE OF SULPHATE OF AMMONIA.

Dipl.-Ing. Schumacher in *Das Gas- und Wasserfach*, 1934, 77, 337-339 (May 26), describes the method by which sulphuric acid, in amount equal to one-fifth of the daily requirements for sulphate of ammonia manufacture, is recovered at Frankfurt from the devil gases of the ammonia saturator. The process, which was developed by the Metallgesellschaft A.-G., of Frankfurt-on-Main, enables the cost of treatment of ammonia liquor to be reduced—a useful feature in these days of unremunerative ammonia recovery.

The devil gases from the saturator, containing 20-30% of H_2S (the remainder being CO_2, HCN, phenol, &c.), are burnt with excess air. The products of combustion, containing 3-5% SO_2, 3-8% H_2O, 7-9% O_2, and a balance of CO_2 and N_2, are led over a vanadium catalyst at a temperature of 400°-450° C., and the sulphur dioxide is thus oxidized to sulphur trioxide. The water vapour present does not affect the conversion. At the temperature of the reaction, the sulphuric acid is dissociated almost completely into sulphuric anhydride and water vapour. The sulphuric acid is not recovered by a scrubbing process as it is in the ordinary contact process. The method of recovery adopted is the condensation of the vapours at a definite temperature whereby a condensate of 90% sulphuric acid is obtained, the excess of water vapour escaping to atmosphere. The process is thus independent of the water vapour content of the gas mixture. This method of working is a new one in the sulphuric acid industry. The conditions necessary for the efficient condensation of the sulphuric acid were studied on a laboratory scale, and a satisfactory large-scale condensation apparatus was developed.

The combustion of the devil gases from the saturator takes place in a vertical furnace consisting of an insulated brick-lined iron cylinder. The saturator gases are admitted under slight pressure at the base of the furnace where a pilot flame is situated. The air supply is readily regulated by means of dampers, though it does not matter whether the SO_2 content of the combustion gases varies between 3 and 5%. The combustion gases pass by way of an outlet main to the contact chamber—an air-cooled cylindrical vessel containing three perforated trays on which the catalyst rests. The air-cooling is effected by natural draught by means of a shell surrounding the reaction cylinder. The cooling shell is used for the supply of heat when the plant is started up. For this purpose, a burner is inserted into the air inlet. The necessary reaction temperature is reached within a few hours. The burner is also used if the plant is idle for as long a period as four hours. A vertical condenser forming an extension to the lower end of the contact chamber serves for the condensation of the sulphuric acid which collects in a sump at the base of the condenser and is drawn off through a U-seal. The condenser consists of a series of vertical tubes encased in a shell in which water or, if need be, oil circulates. To avoid scale formation when water is used, the water is circulated in a closed system being re-cooled by means of an auxiliary cooler. An exhaust fan connected to a main near the base of the condenser creates a pull of 12-14 in. of water through the plant and serves to draw the gases through the plant and to evacuate the waste gases which leave at a temperature of about 90° C.

During the course of a day's working, the SO_2 content of the combustion gases varied between 3·9 and 5·1%, the temperature at the inlet to the contact chamber varied between the narrow limits of 450° and 470° C., and the percentage conversion of the SO_2 ranged from 89·6 to 95% with an average of 92·2%, the monthly average ranging from 91 to 93%. By stricter control, a recovery as high as 97-98% can be realized. The inlet temperature to the contact chamber is an important one and should not be allowed to fall below 400°-450° C. It is controlled by means of a recording pyrometer fitted with an automatic alarm which comes into action if the temperature falls below 400° C., and an adjustment to the air dampers is then made. The brickwork of the furnace exerts a smoothing effect on the temperature in virtue of its heat capacity.

Conditions are so adjusted that 90% sulphuric acid is obtained. The acid is water-white in colour and is so pure that it may be directly employed as accumulator acid.

At the Ost works, about 210,000 to 250,000 c.ft. of saturator gases are treated daily. The gases are first cooled to 20°-30° C. by passage through a water-cooled counter-current cooler. The daily make of acid is equivalent to 1·1-1·2 tons of 100% sulphuric acid or 1·4 to 1·55 tons of 60° Bé. acid. During an operating period of 50 days, one-fifth of the acid required for sulphate of ammonia manufacture was produced. Condensation of the sulphuric acid is almost complete (99·8-99·9%) and the waste gases leaving by way of the fan contain only traces of SO_2. Operating costs are very small. The plant, which is run by the ammonia plant staff, involves a power consumption of about 40 KW.-H. per day and the use of 3,300-4,400 gallons of cooling water for the re-cooling of the condenser water. Figures are not yet available for depreciation costs and cost of catalyst.

It is proposed to carry out further investigations with the object of utilizing, via the saturator gases, a still further proportion of the sulphur content of coal gas.

The President, President-Elect, Hon. Secretary, Hon. Treasurer, and Members of the Committee.

Waverley Association OF Gas Managers

ANNUAL MEETING, GOOLD HALL, EDINBURGH, June 29.

The Waverley Association of Gas Managers held their Annual Meeting in the Goold Hall, Edinburgh, on Friday, June 29. The President of the Association, Mr. George P. Mitchell, M.Inst.C.E., M.I.Mech.E., Engineer and General Manager, Worcester New Gas Light Company, occupied the chair.

At the outset, the President extended a warm welcome to the members and expressed his pleasure at finding such an excellent attendance.

The PRESIDENT then announced with regret the loss sustained by the Association through the death of Mr. Alexander Russell, of Glasgow. A silent tribute was paid to the memory of Mr. Russell by the meeting.

The SECRETARY AND TREASURER, Mr. R. J. Philp (North Berwick), read the minutes of the last meeting, and after these had been adopted the following new members were admitted to the Association:

New Members.

Ordinary Members.—Messrs. A. McDonald, Motherwell; R. D. Keillor, Greenock; James Hunter, Dollar; D. Melvin, Edinburgh; Robert Cowie, Junr., Hawick; James Wightman, Rosewell; Alexander Anderson, Newtongrange.

Extraordinary Members.—Messrs. H. Rule, c/o Messrs. D. G. Allan & Co., Ltd., 166, Buchanan Street, Glasgow, C. 1; F. P. Watt, c/o Messrs. Rainwater Castings, Ltd., Ashton-under-Lyne; Charles Gray, 49, Grange Road, Leigh-on-Sea, Essex; W. G. Head, c/o Messrs. Humphreys & Glasgow, Ltd., London; Colonel Peebles, Tay Works, Bonnington, Leith.

New Officers.

The election of the office bearers for next year was then proceeded with.

The PRESIDENT proposed that Mr. Eric Shiell, of Langholm, be invited to accept the Presidency of the Association for the coming year.

Mr. R. W. COWIE (Hawick) seconded this.

Mr. SHIELL expressed his appreciation of the signal honour bestowed on him by the Association.

Mr. R. J. Philp, the Secretary and Treasurer, and Mr. J. O'Halloran, the Auditor, were re-elected for the coming year, while Messrs. R. J. Gavin, Melrose, and R. W. Cowie, Hawick, were elected to the Committee for two years.

Presidential Address.

The President then delivered his Address. This, and a report of the discussion which followed, begin on the next page.

Presentation of Medal to President.

Mr. GEORGE BRAIDWOOD, of Coatbridge, said that as immediate Past-President, it was his privilege to present Mr. Mitchell with a Medal as a memento of his year of office as President of the oldest Gas Association in the world. No President had been more worthy of this honour than Mr. Mitchell.

Mr. MITCHELL, returning thanks, said that he would always treasure the gift. He also appreciated the honour bestowed on him, the more especially as he had been away from Scotland so long.

Vote of Thanks.

Mr. J. BELL (Dumbarton) proposed a vote of thanks to the President and retiring members.

Luncheon.

At the conclusion of the meeting the members adjourned to the North British Station Hotel, where they lunched together.

Mr. JAMES JAMIESON (Edinburgh) proposed the toast of "Kindred Associations," coupled with the name of Mr. A. S. Nisbet, immediate Past-President of the North British Association of Gas Managers. He said that the Waverley Association was the undisputed father of the flock, and that they placed themselves second to none in importance among the many Associations connected with the Industry. It was, however, with the greatest sincerity that they extended to these sister Associations the hand of good fellowship and wished them prosperity. He was particularly pleased that they had with them Mr. Nisbet, the immediate Past-President of the North British Association of Gas Managers, who had discharged the duties of this high office in such a distinguished manner. Mr. Jamieson regretted the absence of Mr. Bain, the President of the North British Association. He then referred to their close co-operation with the Technical Associations which, he said, would facilitate the solving of the problems of their Industry.

Mr. A. S. NISBET, of Paisley, replying to the toast, said he too regretted Mr. Bain's absence. To-day, he remarked, many changes were taking place in their industry, some welcome, others not. The mechanization of industry with its consequent displacement of labour was not an unmixed blessing, but perhaps now they were about to enter a better period. He stressed the need for good fellowship among the Associations.

Mr. GEORGE BRAIDWOOD, of Coatbridge, proposed the toast of "The Chairman." Mr. George Mitchell, he said, was the worthy son of a very distinguished Engineer, the late Mr. Robert Mitchell. He was, moreover, a splendid example of the type of man they wished to see representing Scotland in the South.

The CHAIRMAN thanked the members for their support. He said he appreciated the great honour which they had conferred on him, and it would always give him pleasure to look back on his year of office. He had not had the guidance which he would have liked from his father, being only eight years old when his father died, but he had been assisted very materially by Mr. Napier, of Alloa, and Mr. Taylor, of Barrowfield.

The PRESIDENT proposed the toast of "Mr. J. Scott," the Secretary of the Golf Clubs of the Waverley and the North British Associations of Gas Managers.

Mr. SCOTT, replying to the toast, said that his duties gave him great pleasure.

During the lunch the company were entertained by songs from Mr. J. D. Luck, of Carluke, and humorous recitations by Mr. R. W. Cowie, of Hawick.

Bowling and Golf.

A bowling competition was held on the North Berwick Bowling Club's Green, and was won by the following team by 12 shots: Messrs. R. Robson (Sunderland), J. Wilson (Dalry), R. Harvey (Lockerbie), and W. Mann (Stevenston), Skip.

On the day preceding the annual meeting a competition was held over the North Berwick Burgh Golf Course.

The Scratch Prize was won by Mr. R. Stewart, of Auchterarder, with a score of 75.

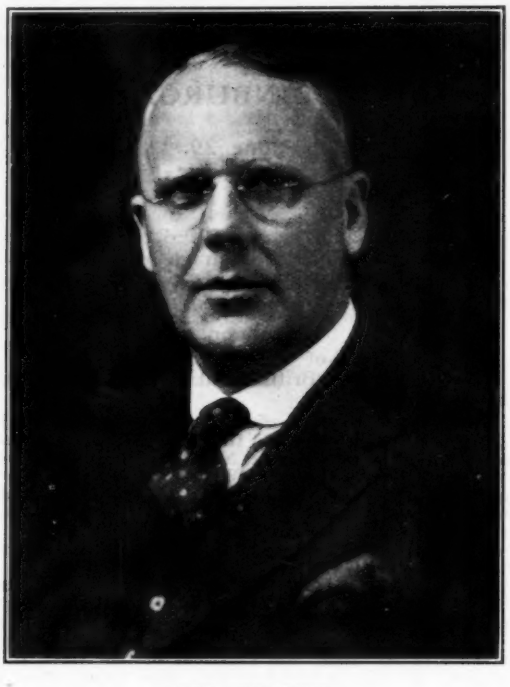
In Handicap Section I., Mr. Stewart took the First Prize, and in Section II. Mr. D. H. Munro, of Glasgow, was the successful competitor.

Presidential Address of George P. Mitchell, M.Inst.C.E., M.I.Mech.E.

[Presented at the Annual Meeting of the Waverley Association in Edinburgh on June 29]

I take this opportunity of again expressing how highly I appreciate the great honour you have conferred on me by electing me your President. Almost fifteen years have now elapsed since I left Scotland, and the exalted position of now occupying the presidential chair gives me infinite pleasure.

We were indeed fortunate in having such a splendid address last year on the economic production of therms



THE PRESIDENT.

Mr. G. P. MITCHELL, M.Inst.C.E., M.I.Mech.E., of Worcester.

Mr. G. P. Mitchell was educated at George Watson's College and Heriot Watt College, Edinburgh, and from 1904 to 1910 served with Messrs. Bertrams, Ltd., Engineers, of Edinburgh, and Messrs. Barrowfield Ironworks, Ltd., Glasgow. In the latter year he was appointed Chief Assistant to the Engineer and Manager of the Gas and Electricity Departments at Alloa, and two years later took up a similar position with the Dundee Gas Department. During the war years Mr. Mitchell was Engineer and Manager of the Port Glasgow Gas Department, while from 1918 to 1919 he was in charge of the Falkirk Gas Department. From then until 1933 he was Engineer and General Manager at Blackburn before taking up the similar appointment he now holds with the Worcester New Gas Light Company.

from coal, during the discussion on which I was interested to hear one of the members remark—what they wanted was cheap therms to the consumer. It is certainly one thing to produce cheap therms, and another to sell cheap therms, as so many problems present themselves during the process of manufacture and distribution.

In presenting this short address I should like to express my views as to how this gap might be bridged. While I was gaining experience in the Gas Industry in Scotland I had the privilege of serving under two of the foremost gas engineers, both of whom at that time had the distinction of selling gas at a very low figure, and, having regard to the policy they followed, the need for "wise spending" has always been uppermost in my mind. By spending wisely your capital will never become a burden. I emphasize the word "wise" because although your undertaking may be heavily capitalized, it may well be that by incurring additional capital expenditure you will be able to place your undertaking on a sounder financial basis; for such expenditure, if wise, will enable you, not only to repay the new charges in a short period, but to reduce the outstanding debt more quickly. Personally, I do not believe in long period loans, because one never knows what science may bring forth during the next fifteen or twenty years. Perhaps I may be permitted to mention a case in point bearing out what I have just said.

When I left the Bairns of Falkirk for England I found the outstanding debt on the undertaking across the Border to be £804 per million c.ft. sold. Owing to the war period extensions, &c., had been delayed, and I was therefore confronted with heavy expenditure on new works and also upon the distribution system. In the short space of ten years, however, this was accomplished. Works were put up which were able, not only to meet present-day requirements ("GAS JOURNAL," March 23, 1927), but to take 25% additional load, while the debt per million c.ft. was reduced to £402, and the selling price of gas reduced by 1s. 5d. per 1,000 c.ft., or 28%. In order to achieve this result sales had to be increased simultaneously (fig. 1); later in my address your attention will be directed in a general way to the method by which this was done.

The Gas Industry has attained its present position and success because it supplies to the public smokeless fuels, gaseous, liquid, and solid, and a large number of bye-products scientifically produced and utilized, in place of raw coal, the use of which is not only a menace to health and property, owing to the smoke nuisance, but is extremely wasteful. If continued success is to be secured in the form of increased sales—and I have no doubt that it can be secured—it is essential, among other things, that the processes which we apply to coal shall be so efficient and economical, and the products we produce so desirable, that we shall be able successfully to compete not only with coal, but with all other forms of heat, light, and power.

The fundamental part of our operations is the carbonization of coal, and it is clearly of the first importance that in doing so the highest efficiency should be sought after. Carbonizing plant is constantly being improved in design and in working, and it is wise spending to get the best you can afford. Increased thermal efficiency, increase in output, diminution of expenditure, care in the choice of fuels, and increase in the value of bye-products are all means to the end which we must constantly have in view. Sight must not be lost of the potentialities of low-temperature carbonization and of the production of gas otherwise than by retorting, through blue water or carburetted

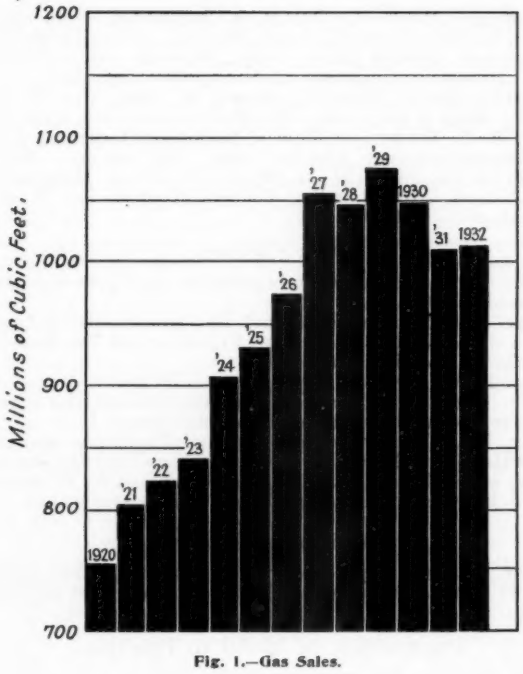


Fig. 1.—Gas Sales.

water gas plant, nor, if opportunity offers, of taking coke oven gas. Many undertakings are now taking supplies of the latter, and though a variety of risks have to be borne in mind, in practice the supply has been satisfactory.

Reductions in Production Costs.

I do not pretend to have given an exhaustive list of the ways in which we may be able to effect reductions in production costs without interfering with the high quality of

the gas supplied; nor is it necessary that I should do so in a gathering of technicians to whose minds other methods will readily occur. I may mention, however, certain developments of a more detailed character, which are undoubtedly of importance.

The degree of purification which we are able to attain has been greatly improved in recent years, and the introduction of gas dehydration and naphthalene extraction on the works now makes it possible to distribute gas continuously without danger of mains or services becoming partially stopped owing to the presence of water, rust, and naphthalene. This is of great importance, particularly in the older towns where streets are congested and mains and services have been for some time inadequate to meet the demands made upon them.

After removal of water and a thorough clearing of mains and services, the gas carrying capacity has in many cases been found to be so much improved that consumers who have previously complained of inadequate pressure at peak loads have been supplied to the limit of their requirements without difficulty. Insufficient pressure is not only a nuisance to the consumer but results in a definite loss of revenue to the gas undertaking, and should now be absolutely a thing of the past.

All these improvements have also resulted in a more satisfactory condition of burners and apparatus, and a correct mixture can be maintained over longer periods. Such improvements no doubt take a considerable time to mature, but in these days of keen competition it behoves everyone of us—confident as we are in the excellence of the commodity which we supply—to look ahead.

There are still two important problems to be solved:

(1) The occurrence of gums, on which the Institution is now conducting an investigation. This phenomenon, though troublesome in the case of certain undertakings, is fortunately by no means widespread, but with increasing use of thermostats and small pilot flames this may assume greater importance.

(2) Sulphur compounds. This impurity is one of the most serious obstacles to increased sales of gas. We do not need to look far ahead to see that it would be wise spending indeed to take measures to curtail this nuisance. To mention but a few of the troubles due to sulphur compounds, there is the formation of solids upon the nipples of burners, the production of fumes from flueless apparatus, and corrosion by the products of combustion.

Continuity of supply is, of course, essential, and in this respect we are able to show a very much better record than electricity, which is subject to general failures, whether at power stations, main switches, cable junction boxes in streets, &c. A general breakdown in gas supply is almost unknown, and owing to improvements in servicing it is now possible to avoid, to a much greater extent than formerly, interruption of supply to individuals. This is obviously a strong selling point, and should be driven home at every opportunity.

Production of Bye-Products.

While our principal function is the production and supply of gas for all purposes, we necessarily produce a wide range of bye-products, and as the prices at which we can dispose of these have a vital bearing upon the price at which we can sell gas, it is of the utmost importance that they should be rendered as desirable as possible. Within the limits of a short address it is not possible even to mention all the bye-products of gas manufacture, still less to make suggestions as to how their value may be enhanced for selling purposes, but I would like to give you one or two examples.

Considering our main bye-product, coke, there are several factors which affect its nature, such as the methods of carbonization employed, the type of coal used, &c., and the subject is one which is under investigation at the present time. Taking, however, ordinary gas-works practice, it should be the aim of all to produce a free-burning coke, with a minimum of ash and sulphur. To do so, the most suitable coals must be selected, but the choice may be limited by the plant in use at the particular works. Here, again, wise spending may dictate a change or re-modelling of plant. The coke must then be graded and sized so as to meet the particular requirements of consumers, and, finally, whenever practicable an effort should be made to ensure that it is burned in suitably designed grates.

Service after sales should be given with coke, as well as with gas; service always increases the value of a commodity. I can foresee the need to increase our efforts not only in preparing coke but in selling it—just as we have had to waken up to the need for really selling gas.

Another example is tar. That, again, is a subject in itself, but I would recall to your minds that within the last 25 years a new industry of considerable magnitude has been built up on tar as a road-binding and surfacing medium, and it behoves all those who make road tar so to treat the tar which we produce as to give it, in the greatest possible degree, the properties demanded by those responsible for the making and upkeep of the highways of this country.

The latest bye-product to become a common feature in gas making is benzole. The production of a supply of home-produced motor fuel is something which the man in the street is able to appreciate and value, and I suggest we do not take enough credit for this service. Practically every gas undertaking is able to produce benzole, some at a higher rate per ton of coal carbonized than others, and the modern recovery plant has become so compact and automatic in operation that the low cost of recovery, in conjunction with the protection afforded by the duty on imported spirit, makes the profit earned very attractive. At present there appears to be an unlimited market for this product, and it is well worth the attention of all those who are anxious to make the best of their bye-products.

Selling Gas and Gas Appliances.

In turning to the side of our business most in need of development—that of selling gas and gas appliances—we have one of our most difficult, but also most interesting, problems. The competition from electrical, coal, and oil interests is tremendously keen, and our own sales efforts must be strengthened and increased relentlessly to obtain a fair share of the business that is available. The present method of charging adopted in most undertakings is not conducive to increased outputs, but I am of the opinion a great deal more could have been done in the past by giving the prepayment consumer more generous terms. You will find in some instances the difference between prices charged to the ordinary and prepayment consumer is as much as 1s. 6d. per 1,000 c.ft. This may or may not include free fittings, but I am certain that in this respect many of us have missed a good opportunity and rendered ourselves vulnerable to our competitors, who have no doubt had their eye on this class of consumer from the very outset.

It may be of interest to know that my predecessor in Blackburn, prior to my taking over in 1919, reduced the margin to 1d. per 1,000 c.ft., and I further extended the privileges granted to the prepayment consumer by way of hire purchase terms through the meter, over a period of 3, 6, or 10 years. The result of that action has been astounding, as you will gather from the figures given.

Year Ending March 31.	Prepayment Consumers. Average Consumption per Prepayment Meter.	Average Unemployment Figures.
1919	11,858 c.ft.	10,762
1920	14,105 ,,	19,075*
1921	15,830 ,,	10,427
1922	17,971 ,,	10,992
1923	17,522 ,,	5,285
1924	18,654 ,,	4,199
1925	19,621 ,,	8,119
1926	20,383 ,,	8,656
1927	23,434 ,,	7,723
1928	22,441 ,,	7,804
1929	22,619 ,,	21,370
1930	22,231 ,,	26,631
1931	21,475 ,,	21,295
1932	20,563 ,,	19,714

* Dispute in cotton industry.

Continuing the subject of gas charges, there is much discussion upon the subject of the ideal tariff. What is the ideal tariff? The salesman can answer that right away—"It is the tariff that gets the business." But to obtain all classes of business it is becoming evident that unless circumstances are most propitious, more than one rate or scale is necessary. That, at least, has been my personal experience. Then, if the salesman puts into operation an increasing number of special rates for various purposes, the accountant may put the justifiable query—"Where is this going to end?" So on the one hand we have the urgent demand for flexibility and freedom in quoting for new business and, on the other, the appeal for system and uniformity. The question is how to blend the two. Where one rigid system of rates is in operation it is possible that they may not attract one class of business, and yet walk away with another class which would have stood a higher rate. So in the one case we lose business and in the other we lose revenue. Therefore separate rates must be prepared for application to the various classes of business we are developing. Even then a special case may crop up calling for a modification.

In our small way in Worcester we are endeavouring to make the punishment fit the crime, and to induce new

industrial and commercial business by offering an attractive commodity rate *plus* a variable fixed charge. Admittedly we have as yet only a few customers on a two-part rate, but they are new ones, and it is of interest to note that these fixed charges are at present bringing us in from 2¾d. per 1,000 for an approximate 10 million load to 4½d. per 1,000 c.ft. for a load approximating ¼ million. Ordinarily we might have been satisfied to obtain such loads at the bare commodity charge, but having made an offer on a flat rate we were pressed for a reduction and compromised by offering the two-part rate embodying the commodity charge desired by our prospects.

Quantity Rates.

This brings up the subject of rates varying by quantity only, irrespective of purpose or time of use. Many such rates have we studied, and most of them seem illogical, for this reason. They start off with minute concessions in the early part of the scale and then make lavish reductions when someone takes, say, 8 millions per annum instead of 7. Put in the form of a graph, this type of scale appears as in fig. 2.

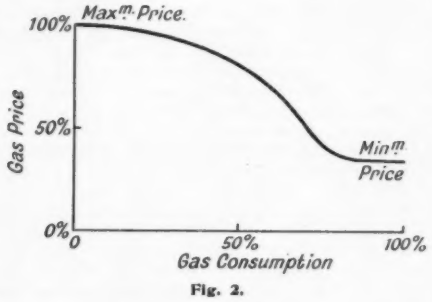


Fig. 2.

Of what value is this in promoting business? Surely very little. We can confirm this view by calling to mind offers from almost any firm at random for articles in quantity. Take gas fires if you like; the price is dropped most for the dozens, and the progressive drop in the hundreds is smaller until only fractions can be saved by ordering thousands. Perhaps my accountant friends will correct me, but even if they do I will still maintain that quantity scales would serve a very useful purpose and more nearly approach the ideal tariff if they dropped 6d., 9d., or 1s. per 1,000 c.ft. after the initial small block of, say, 5,000 c.ft. per quarter was exceeded.

The graph for this type of scale follows the curve shown in fig. 3, which I would put forward as indicating the mathematically correct fall in price with quantity:

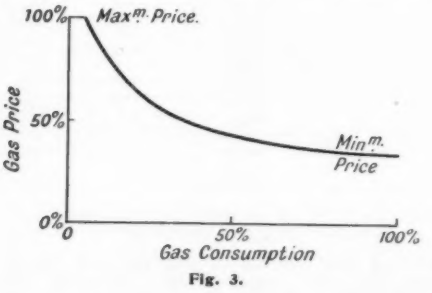


Fig. 3.

There are a few notable examples of this form of scale, and no doubt the salesmen using them are reaping a good harvest.

A further point which I fear is going to trouble several gas undertakings, as a result of their desire to extend the use of gas in its earlier days, is that of free and simple hire of appliances. In many cases it means that those unfortunate undertakings which have not only spent capital in acquiring and installing such appliances, but money on maintaining them in the past, are now faced with further expenditure owing to the need for replacing obsolete cookers with more modern articles in order to compete with up-to-date cookers offered by the electrical undertakings. Here, again, I might mention that at Blackburn in 1920 all privileges granted so far as simple hire was concerned were stopped, and appliances could only be obtained for cash or on hire purchase, the period of repayment being extended from 3 years to 6 and 10 years.

I consider the saving to the consumer by elimination of cleaning and repairing hired cookers was equal to at least 1d. per 1,000 c.ft. on the gas consumed, while the undertaking was not handicapped by dead stock, and, in addition, they have so consolidated their position as to be able to stand more than the usual attack from any electrical concern.

The number of appliances sold in the year prior to the introduction of this scheme was only 376; including cash and hire-purchase sales, the average for the subsequent 12 years was 3,000 per annum (fig. 4), so you can see how readily consumers in a distressed area (fig. 5) have fallen

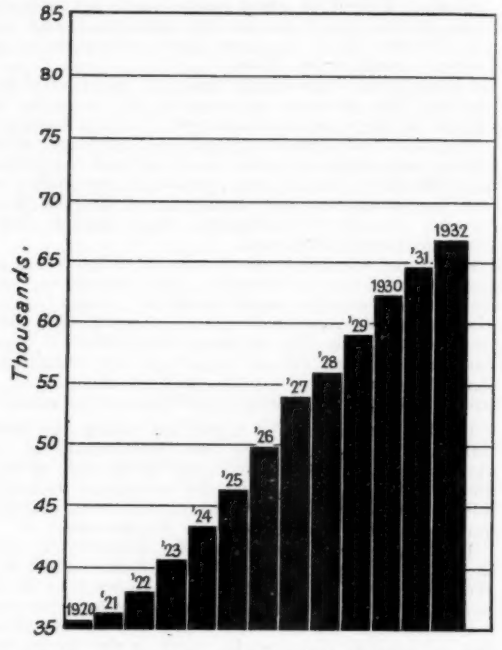


Fig. 4.—Gas Appliances in Use (Fires, Cookers, Heating Appliances).

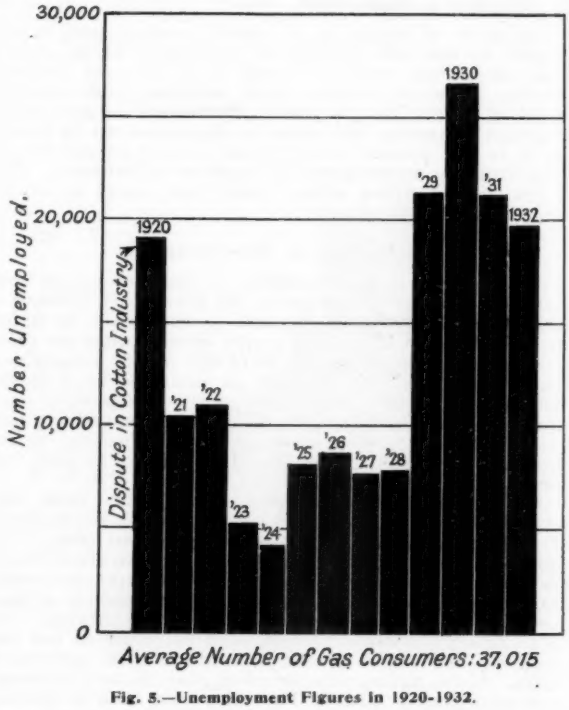


Fig. 5.—Unemployment Figures in 1920-1932.

for this scheme. My only explanation is that they feel they are in a way capitalizing their savings by purchasing something from which they obtain a fair return. Even at this late hour I would respectfully suggest to those who have apparatus out on the simple hire system that every endeavour should be made to consolidate their position by offering for a small cash payment the appliance now in use, or a better appliance at a slightly increased amount on hire-purchase terms, over a period of years, rather than

pursue the old method of simple hire. I emphasize this point because there is no doubt the electrical people will fall into the same trap as we ourselves have done when their apparatus becomes obsolete and they are faced with standing charges and nothing to show but a scrap heap.

Appearance and Comfort.

No doubt it is difficult to face the wholesale scrapping of appliances issued to consumers, but I am convinced that if we are to meet competition successfully we must "screw our courage to the sticking point." Not only is greater efficiency now demanded of our appliances, but appearance and comfort must be studied. Our competitors offer the most attractive designs, but we can and must go one better, and we have a special advantage in that we can offer apparatus possessing refinements, such, for example, as thermostatic control of cookers, which electricity cannot offer as yet.

Wise spending in the direction I have indicated will, I am confident, repay those who undertake it, and more quickly than they anticipate.

In this connection, and, in conclusion, I would like to say a word about the benefits which have resulted from the setting up in England of a chain of Development Centres with a view to extending the use of gas for all purposes, and particularly for commercial and industrial purposes. The scheme is in active operation and has already proved of very great benefit to individual undertakings all over the country, and I understand that it is now being taken up in Scotland. The essence of the scheme is co-operation, by means of which information as to new methods of using gas, and as to improvements in old methods, are made available to all who take part. Large undertakings which have on their staff technical experts, who alone are in a position to impart information and advice in regard to possible uses of gas, are pooling their knowledge and thus making it available to those who otherwise could not acquire it, and in this way many undertakings are finding it possible to sell gas for industrial purposes where previously they had regarded it as impossible to do so. Even towns which are not industrial in the strict sense have derived benefit from the scheme, for hitherto unsuspected avenues of development have been opened out to them in the shape of supply to laundries, bakeries, garages, and dairies, and many have been able to improve their central heating and water heating loads by offering to their consumers the most modern and efficient methods of utilizing gas for these purposes.

None of us can afford to neglect any opportunity of increasing our efficiency in every phase of our activities. If we do so we shall inevitably be left behind, for our various competitors are ready to take immediate advantage of any failure on our part. But just as in the past we have, as an Industry, faced difficulties and created opportunities for ourselves, so to-day, despite fierce competition and difficult economic conditions, we can, by our individual and united efforts—and these I know will not be wanting—ensure that the future of the Industry to which we belong shall be even brighter and more useful than the past.

Discussion.

Mr. GEORGE BRAIDWOOD (Coatbridge), in opening the discussion, said that Mr. Mitchell's address was most statesmanlike. He had treated his subject in a most balanced manner, never attaching too much importance to any one department. His early training in Scotland had undoubtedly given him that degree of caution shown by his advice on "wise spending." Mr. Mitchell had referred to the possibilities of taking coke oven gas, and had said that many undertakings were now taking supplies of this gas, and that although a variety of risks had to be borne in mind, the supply of such gas had been satisfactory. Since the supply of coke oven gas was receiving much attention in the West of Scotland he would like Mr. Mitchell to enlarge on the variety of risks attendant upon the taking of this gas. Mr. Mitchell's suggestions regarding tariffs for gas were very welcome in view of the new legislation, when they would be permitted more licence in charging by special contract. He thought that the two-part tariff system had been the saving of the Gas Industry in its competition with electricity.

Mr. JAMES JAMIESON (Edinburgh) hoped that because of Mr. Mitchell's advice on wise spending, his own undertaking would not be accused of unwise spending. He then gave figures (see top of next column) comparing the expenditure and revenue at Granton, Edinburgh, with that of Blackburn, which amply justified their expenditure.

Mr. Jamieson observed that the price of tar had dropped a great deal in the last six months due to competition among the tar distillers, who obtained 90% of their supply from gas-works. He disagreed with the withdrawal of the free loan system for gas appliances. This system, he said, had been the backbone of the Industry and must be continued until appliances could be given at very low rates of hire purchase. He concluded by congratulating Mr. Mitchell on the excellence of his address.

—	Edinburgh.	Blackburn.
Outstanding debt per million, 1920	£750	£804
" " " " , 1932	£279	£402
Spent over £750,000, and capital debt is now less by nearly £250,000, which shows increased assets of £1,000,000		
Output of gas, 1920	2,191 millions	750 millions
" " , 1932	3 367 "	1,020 "
Increase over	50%	35%
Price of gas, 1920	4s 11d.	..
" " , 1932	2s. 9d.	..
Reduction of 2s. 2d. =	40%	28%
Prepayment meters—		
No. of meters, 1920	16,000	..
" " , 1932	29,000	..
Increase over	80%	..
Average consumption per meter, 1920	9,622 c.ft.	..
" " " " , 1932	18,901 "	..
Increase	96%	..

Mr. R. W. COWIE (Hawick) remarked that a gas cooker and a boiler and perhaps an iron were fitted into most of the modern houses in his town. When these appliances were taken 1d. was charged for 10 c.ft. of gas instead of 1d. for 16 c.ft. until they had been paid for. He then related how some of the mills had installed Diesel engines, and that they wanted a stand-by. The electricity company refused to supply these and his Company had installed them at each of the mills' expense. There had been some talk about a gas grid scheme for the district. Over 200 farmers had requested a supply, but the ratepayers would require to pay an additional tax of 6d. in the £ to make this possible, which he considered to be unjust.

Mr. D. FULTON (Helensburgh) stressed the point that the present cooker was not the final one, and that they would always be faced with the problem of renewing them. The hire-purchase system had been extolled also at the meeting of the North British Association of Gas Managers. He thought that the period of hire purchase should be extended to compete with electricity. Cheaper appliances should be made, and replaced about every seven years. No one wanted a cooker which would last for 70 years. He considered that for future development the small works must amalgamate. Although they could make and distribute gas as cheaply as the large works they could not afford to give the attention necessary to the selling side. For central heating the consumer wanted gas at a cost little above that of solid fuel. He considered that this could not be done for such small loads as 250,000 c.ft. per annum. He would welcome the formation of development centres, especially as assistance would be given for the sale of gas, but he hoped that everyone would still continue to strive to advance the Gas Industry.

Mr. D. VASS (Perth) made some remarks concerning gas tariffs. He suggested that when separate systems were used for industrial and domestic consumers many large houses using a lot of gas were not benefited sufficiently. He considered that one block scale system should be used for all consumers, and that the steps should be so adjusted as to entice the consumer to use additional appliances. At present their period for hire purchase was five years, but he thought that this should be increased to ten years, with perhaps a shorter period for boilers. Although they made only a nominal charge for a black cooker, a much greater demand existed for the enamelled one.

Mr. J. BELL (Dumbarton) congratulated Mr. Mitchell on his very optimistic address. He said that a graded tariff was used for all consumers in Dumbarton. The slot meter user received the advantage of the first step down of the block system. He considered that the second and third steps were not steep enough to encourage the use of gas.

Mr. T. W. HARPER (Ayr) said that there was no "ideal" tariff; it should vary according to locality. They had a sliding scale for all consumers, including slot meter users. The gap between the first and second steps should be narrow, but, most important of all, the initial price of gas should be low. Despite the attractive two-part tariff (the lower rate being only ¾d. per unit) offered by the electricity company his undertaking had increased their sales by over one million c.ft. per annum. He attributed this to the constant pressure and quality of the gas supply. He thought that in their fight for business the trouble-free nature of gas supply should be stressed.

The President's Reply.

Mr. MITCHELL congratulated Mr. Jamieson and his predecessors for their work at Granton Gas-Works. Their capital expenditure was certainly justified by the good results they had obtained. Regarding the supply of gas appliances, he said that he disagreed with the general view that simple hire was safer. He considered that the hire purchase of appliances over a period of about ten years was preferable. Consumers would, under this system, take more care of the apparatus, and, more important still, they would be less ready to change over to electricity if they owned the gas apparatus. It was so easy to make this change when the apparatus had been obtained on the simple hire system. Mr. Milne, of Aberdeen, had to be congratulated on his scale of charges, the price having been reduced from 5·4d. per therm to 4·2d. per therm. They all looked forward to arriving at that goal. Edinburgh was gradually nearing it. Mr. Mitchell said that at Worcester they were holding their own in the competition with electricity, and that they were increasing their gas output by 10% each month.

New Plant at Neath

W.-D. Continuous Verticals

THE NEW COKE SCREENING PLANT SHOWING THE WOODALL-DUCKHAM "UNDULO" SCREEN.

On Thursday last a new installation of Woodall-Duckham upwardly-heated continuous vertical retorts was inaugurated at the Neath Gas-Works. A special feature of the plant is an entirely new type of coke screen—the W.-D. "Undulo"—of which we publish an illustration.

The new installation consists of one bench containing eight latest type upwardly-heated Woodall-Duckham continuous vertical retorts, and is capable of carbonizing 36 tons of coal and producing 753,000 c.ft. of 430 B.Th.U. gas per day. The gas used for heating the retorts is made in two producers situated at ground floor level at one side of the bench.

The new installation is erected at the end of an existing bench of Woodall-Duckham continuous vertical retorts. The old installation consists of twelve downwardly-heated retorts, and in the original design and erection of both plant and retort house, provision was made for the present extension to be carried out, when the necessity should arise.

Thus it has been found possible to extend the coal and coke handling arrangements on the old plant to serve the new. At the same time a new type of coke screening plant has been installed for grading of coke from both the old and the new plants.

Coke is discharged from the skip on the gantry into a chute which delivers it on to the Woodall-Duckham "Undulo" screen.

In this design the screening medium consists of a series of rubber sheets perforated with appropriate sized holes to allow the required grades to fall through. The continuous series of sheets is suspended from fixed cross-bars with sufficient sag to form valleys. By means of a suitable mechanism these valleys are converted into ridges in a sequence which causes a continuous forward motion of the coke from the feeding to the discharge end. The rolling and tumbling action of the coke as it passes over the valleys causes it to drop through the appropriate holes and the efficiency of this action is accentuated by a certain amount of back sliding of the smaller coke from the ridges as they form. The screen conveys the coke over the storage bays as it screens it so that there is no necessity for chutes to direct it into the appropriate bays. Also, as it has an upward inclination the large coke bays at the end can be built higher than the breeze bay at the beginning, and storage space is thus economized.

Other advantages of this type of screen are as follows:

(1) Coke breakage is reduced by the use of rubber screens, and breeze formation is minimized.

(2) The slow operating rate requires low motive power (the screen installed being driven by a 3 h.p. electric motor), avoids intensive wear and excessive dust formation, and, vibration being practically absent, there is no necessity for a heavy supporting structure.

(3) Installation and maintenance costs are low.

The new coke screening plant has been in operation since Dec. 1, 1933, and its success may be judged by the fact that sales of coke for domestic use have very nearly doubled during this period.

There was a large attendance of local public men, officials, and representatives of other gas undertakings present at the inauguration ceremony and the luncheon which followed.

The inauguration ceremony was brief, consisting of an address of welcome by Councillor GEORGE GETHIN (Chairman of the Neath Gas Committee), after which the new plant was put into operation. Councillor Gethin, in extending a hearty welcome to those present, remarked that they were making an effort to keep abreast of the times at Neath, and the improvement was more noticeable to people who knew the works twenty years ago.

The party were entertained at luncheon following the inspection of the plant, where, in the absence of Councillor Gethin, Alderman J. B. Williams (Vice-Chairman of the Gas Committee) presided, and was supported by the Mayor and Mayoress, Mr. and Mrs. W. Clark Jackson, Mr. F. B. Richards (of the Woodall-Duckham Company), and the Town Clerk, Mr. A. E. I. Curtis.

The toast of "The Neath Corporation Gas Department" was proposed by Mr. H. D. MADDEN, who said that it was a great day in the history of the Neath Undertaking, which he had known intimately for twenty-seven years. In 1921 the Neath Corporation put up their first vertical retorts, and what they had seen that day was an immense advance on the installation of 1921. The Gas Department were to be highly congratulated on their wisdom. They had a unit of plant which was less than half the size of the original vertical retort which would turn out the same amount of gas and with a much higher efficiency, both in the gas produced per ton of coal and the quality of the coke. It was a great advantage to have such a plant, and he wanted to congratulate their Engineer on the fine, clean appearance of the whole works.

Ald. J. B. WILLIAMS, responding, said they now had a very up-to-date works. The Gas Industry in South Wales was indebted for all the valuable help and guidance which was so freely

given to them by Mr. Madden and his Company, and which was greatly appreciated by them all. He gave the following figures which illustrated the growth and development of the Gas Department during the last ten years 1924-1934.

—	1924	1934.
Annual output of gas, c.ft.	189 millions	246 millions
Unaccounted-for gas	14%	10·1%
Number of consumers	6,900	8,835
Mileage of mains	40	45¼

The figures represented a very excellent position, and with the additional work which was now being carried out by the Department in the utilization of gas for industry, he had no hesitation in stating that the future of the Neath Corporation Gas Department was well assured as a trading department of which the town could be justly proud.

Mr. F. B. RICHARDS proposed "The Town and Trade of Neath," to which the MAYOR (Councillor E. J. Hopes, J.P.) responded.

Mr. W. J. SMITH (National Gas Council), submitting the toast of "The South Wales Gas Industry," said that he wished to congratulate the Council on the beautiful appearance of their town. Mr. Jackson was District Secretary of the National Gas Council for Wales, and was an inspiration to the movement. He was always full of ideas and very vigorous in his prosecution of the work in hand. It was an enormous help to them in London to receive such support, and, despite the trade depression, the Welsh representatives were always bright and cheerful. The Gas Industry in South Wales was a living force and reflected the Industry throughout the country.

Mr. W. H. JOHNS, of Swansea, in reply, said that he was delighted to assist Mr. Jackson as a colleague in the Industry. The progress made at Neath appealed to him immensely and was a credit to the Gas Engineer and the people who carried out the work. The town was bound to reap great benefits from the plant.

Mr. I. G. JENKINS (President of the Wales and Monmouthshire Association) said that he was glad to hear the opinion expressed that the Gas Industry in South Wales was a living force. They already knew it, but were glad of the emphasis laid upon it. He congratulated Mr. Jackson and the Gas Committee on their wonderful foresight. When the new vertical retort house was erected some thirteen years ago Mr. Jackson foresaw that new extensions would be required and had provided for them. That was exemplified by the symmetry of the new plant.

Councillor J. W. MORGAN (the Deputy Mayor), submitting for the Committee "The Prosperity and Success of the Woodall-Duckham Company," said that he felt sure they were all agreed that the design and workmanship put in by the Contractors on the new installation was of a very high standard. The Committee had been assured by their Engineer that in the early negotiations and right throughout the erection of the plant he had been met by the Company in the friendliest spirit.

Mr. F. B. RICHARDS, responding, offered sincere thanks to those who had paid tribute to the work of the Contractors. They were highly gratified to receive the second order, which was a testimony of their confidence in the Company. He asked Ald. Williams, on behalf of Councillor George Gethin, to accept a Silver Salver as a Souvenir of the work carried out, and he presented Mrs. Clark Jackson with a Silver Rose Bowl.

Mr. CLARK JACKSON, returning thanks, said that Mrs. Jackson and himself would long cherish the memento of the friendly relationships with Mr. Richards and his Company. He felt sure that the new retorts were going to give them the same value of service as the old ones. Great strides had been made in the knowledge of the materials used in the retorts which had only been possible by the amount of valuable research which the Industry had carried out.

The TOWN CLERK (Mr. A. E. I. Curtis) congratulated everyone concerned, and said that since 1920 there had been a revolution in the Neath Gas Department, and Mr. Jackson was the inaugurator of the whole scheme.

"Field's Analysis," 1933

The new publication of "Field's Analysis" for 1933 is now to hand, and it is proposed to give as many extracts from the more important figures as can be conveniently included, with the object of deriving as much information as possible from a review which must unfortunately be limited by the space at our command. Commencing with the sales of gas, the various groups compare with 1932 as follows:

Sales of Gas—Compared with Year 1932.

	%
Metropolitan Companies	Decrease 2·21
Suburban ,,	Increase 0·19
Provincial ,,	,, 0·16
Dublin	,, 1·74
Provincial Corporations	Decrease 1·14
Scottish ,,	Increase 1·06
Belfast	,, 2·08

While these figures are not altogether as satisfactory as one would like them to be, the numbers of consumers show an increase in almost every direction, the additions in the case of the prepayment consumers being very pronounced.

Consumers.

—	Year 1932.			Year 1933.		
	Ordinary.	Automatic.	Total.	Ordinary.	Automatic.	Total.
Metropolitan Companies	757,897	1,237,763	1,995,660	757,757	1,277,561	2,035,318
Suburban ,,	332,646	313,728	646,374	359,913	338,530	698,443
Provincial ,,	459,358	512,885	972,243	463,146	539,119	1,002,265
Dublin	18,799	78,365	97,164	18 870	80,994	99,864
Provincial Corporations	566,983	619,313	1,186,296	556,921	645,684	1,202,605
Scottish ,,	285,881	156,875	442,756	284 222	164,663	448,885
Belfast	57,816	47,225	105 041	55,261	50,910	106,171

The increase in the numbers of consumers has necessitated the laying of greater lengths of main and the figures with regard to this aspect of our business show as follows:

Miles of Main.

—	Year 1932.	Year 1933.
Metropolitan Companies	6,930	7,156
Suburban ,,	3,463	3,890
Provincial ,,	5,405	5,539
Dublin	644	644
Provincial Corporations	6,888	7,018
Scottish ,,	1,870	1,911
Belfast	642	657

From the foregoing figures it is possible to extract averages which show that in the most vital spot—namely, that of the consumption per consumer—the Industry cannot be said to have acquitted itself triumphantly during the past year. The figures are given here and they speak for themselves.

Consumption per Mile of Main.

—	Year 1932.	Year 1933.
	Therms.	Therms.
Metropolitan Companies	50,609	47,850
Suburban ,,	30,191	27,507
Provincial ,,	29,064	28,467
Dublin	17,627	17,934
Provincial Corporations	24,998	24,256
Scottish ,,	29,759	29,428
Belfast	28,721	28,649

A review of this character is not perhaps the place to enter into a dissertation on the question as to the proper

Consumption per Consumer.

—	Year 1932. Ordinary and Automatic.	Year 1933. Ordinary and Automatic.
	Therms.	Therms.
Metropolitan Companies	172·06	164·57
Suburban ,,	156·84	148·87
Provincial ,,	156·19	152·07
Dublin	114·37	113·29
Provincial Corporations	134·46	130·98
Scottish ,,	118·10	117·74
Belfast	162·77	163·68

method to adopt in order to overcome the evil, but as the matter must be faced, it would be a pity if any opportunity

of bringing the question to the general notice of the Industry were missed.

It may be, of course, that the answer can quickly be found in the remarkable advance in the efficiency of the apparatus in use, or in the general need for economy in all classes of the community—or it may be in the ever-growing competition of electricity—but whatever the cause, we should attempt to discover the truth, and then endeavour to find the best means of dealing with the problem.

It is gratifying, however, to find by the following figures that loss of business cannot be ascribed to the cost of making gas, as in every direction, with one minor exception, it is apparent that in the year 1933 the cost was the lowest recorded for the last five years:

Metropolitan Companies.

[Pence per Therm.]

Year	1929.	1930.	1931.	1932.	1933
Net coal	1·290	1·375	1·455	1·368	1·339
Manufacturing charges	2·619	2·518	2·349	2·090	1·799
Charge for capital	1 687	1·745	1·778	1·811	1·847
Cost of production	5 596	5·638	5·582	5·269	4·985
Price received net gas rental.	8·204	8·258	8·189	8·094	8·033

Suburban Companies.

Net coal	2·299	2·217	2·281	2·181	2·090
Manufacturing charges	2·453	2·201	2·244	2·134	2·129
Charge for capital	1·691	1·743	1·757	1·795	1·857
Cost of production	6·443	6·161	6·282	6·110	6·076
Price received net gas rental.	8·676	8·515	8·616	8·583	8·656

Provincial Companies.

Net coal	1·630	1·718	1·916	1·769	1·678
Manufacturing charges	1·697	1·504	1·641	1·628	1·567
Charge for capital	1·385	1·468	1·405	1·431	1·469
Cost of production	4·712	4·690	4·962	4·828	4·714
Price received net gas rental.	6·893	6·798	7·037	6·998	6·884

Provincial Corporations.

Net coal	1·622	1·587	1·638	1·742	1·582
Manufacturing charges	1·702	1·574	1·560	1·592	1·563
Charge for capital	0·732	0·717	0·738	0·724	0·707
Provision for redemption of capital	0·694	0·717	0·741	0·794	0·8c9
Cost of production	4·750	4·595	4·677	4·852	4·661
Price received net gas rental.	8·042	7·966	7·977	7·927	7·878

It is interesting also to extract from the above tables the margins that exist between the actual cost of production and the actual selling price. The difference, of course, covers all the expenses met with in Distribution, Management, and the various other items that go to make up the total cost of the gas supplied; and the thought arises, with such appreciable margins, whether something more could not be done by the various undertakings in accepting extra business at a price which dips somewhat into this difference.

As a general principle it is, of course, essential that business should be obtained at a price which covers all expenses, including the charge for capital, but if it is a question of losing an opportunity of securing additional business or—which is far more unpalatable—the losing of business which has been already secured, it is a moot question as to whether something more cannot be done in the direction of accepting a price for gas at a much lower figure than the initial price—that is to say, something beyond the ordinary run of discounts, which are rarely adequate to meet the situation, providing, of course, the actual cost of making gas and its distribution in certain cases is covered.

With regard to public lighting, it is pleasing to record that in spite of the keen competition from electricity, and in spite of the desire of many local authorities to follow the call of self-interest, the sales under this heading are still increasing, as the following table shows:

Sales of Gas for Public Lamps—Therms.

—	1931.	1932.	1933.
Metropolitan Companies	6,820,907	7,350,705	7,472,446
Suburban ,,	2,971,177	3,170,787	3,024,183
Provincial ,,	5,140,042	5,235,130	5,263,967
Provincial Corporations	12,259,706	12,685,238	12,710,093

From the figures in the Analysis which deal with the financial side of the Industry, it is apparent that its good progress in this respect has been well maintained. In practically all cases dividends at the same rate as the previous year have been distributed with very slight reductions in the amounts carried forward to the next account.

On the whole, while the position revealed by the Analysis shows that the Industry is fully alive, and is undoubtedly progressing, the figures also serve to indicate the matter to which reference has been made, and we must realize that this is no time for resting on laurels, and therefore every effort must be made by the Industry to bestir itself. For this purpose what better means could be offered than the figures afforded by the Analysis?

We have no hesitation in recommending that all and sundry officials, no matter in what capacity they may be employed, should make it part of their education and daily work to obtain a complete mastery of the details and facts given in the familiar Red Book.

In conclusion, we must once again extend to Mr. H. E. Ibbs, the compiler of the work, and his assistants, our congratulations on the completion of the 65th Publication of "Field's Analysis." The work is now on sale, and can be obtained from Messrs. Eden Fisher & Co., Ltd., 6, 7, and 8, Clement's Lane, London, E.C. 4. Price £2 2s.

Economics of the Oil-from-Coal Problem*

By Prof. William A. Bone, D.Sc., Ph.D., F.R.S.

Seeing that so much of the world's transport by air, land, and sea is, or has become, dependent upon petroleum, and that Great Britain, while having practically no natural supply of it, has abundance of good bituminous coal, the question has inevitably arisen whether or not oil can in any way be economically produced from coal in quantities sufficiently large to make it worth while as a national effort.

In considering the matter, it behoves us to take account of its economic, as well as of the technical, aspects. For there is a narrow limit to justifiable expenditure in preparing or up-grading any raw fuel to perform its proper function either under a boiler or in an internal combustion engine. When Nature supplies abundance of petroleum for the mere drilling of a hole into the earth, it is not much that man can really afford to spend upon converting her coal into oil, however clever he may become at it. In this connection, it should be borne in mind that for some years past the c.i.f. prices of imported petrol and fuel oil at our ports have not exceeded 3·5d. and 2d. per gallon, respectively, and that, with a world surplus of oil, there does not seem much likelihood in normal circumstances of their materially increasing for some time to come. On the other hand, it may be thought dangerous in time of war to be almost wholly dependent on foreign supplies of petrol, though, since in any case our food supplies must depend on our keeping the seas open, any failure to do so would mean our starvation into submission. Hence, there may, perhaps, be some who will think it even more important to ensure the supremacy of our navy and mercantile marine, which can only be done by removing trade restrictions, than to foster oil from coal by protective measures. There is something to be said on both sides of the question, and our ultimate policy will depend on

* Extract from the Watt Anniversary Lecture for 1934, delivered before the Greenock Philosophical Society on March 2, 1934.

future circumstances which, at present, cannot be foreseen.

Benzole from High-Temperature Carbonization.

In normal times some 70 million gallons of benzole could be made available by the carbonization of 35 million tons of coal per annum at high temperature in coke ovens and gas-works. But supplies would be uncertain because (*a*) of the dependence of coke manufacture on pig-iron production, which is subject to considerable fluctuation and (*b*) it is problematical whether it would pay gas undertakings to extract benzole so long as they can sell it at 8d. to 10d. per therm in the gas (1 gallon benzole = 1·36 therms). In any case, the amount available would be too small a proportion of our growing requirements to enter seriously into the calculation.

Low-Temperature Carbonization.

Ever since the war low-temperature carbonization has appeared periodically as the "hardy annual" of the coal question, although it is just now resting from the attentions of the Press. A year ago it was well-aired in "Nineteenth Century and After," as a solution to the oil problem, by Sir Richard Redmayne; but, while his views are worthy of all respect, I found them quite unconvincing. He assumed that a ton of coal, costing 15s. at works, would yield 15 cwt. of "semi-coke" value 19s. 2d., 14·55 gallons of tar value 2s. 5d., or a total value of 21s. 7d. at works, as well as sufficient gas to effect the carbonization. Also, that the capital cost of plant capable of treating 300 tons of coal per diem—*i.e.*, 98,350 tons per annum, with a 90% load factor—would be £100,000 and that 25% of the acid and base free tar could be converted into petrol by "pressure-cracking," or, alternatively, 80% of it could be so converted by "hydrogenation." He advocated Parliament enacting prohibition, within 5 years, of the use of bituminous coal in all towns having a population of over 300,000 and maintaining the present excise duty on all imported petrol, or petrol made from imported petroleum, for a stated period of years. Indeed, by such measures he contemplated the eventual replacement of the whole of our present domestic consumption of 35 to 40 million tons per annum of raw coal by low-temperature "semi-coke," with consequent increase in total coal output of 12 million tons per annum, and the production of 100 million gallons of petrol and 2 million tons of fuel oil per annum.

The scheme seems to me open to such serious criticism as almost to put it out of court. In the first place, while the assumption about yields may apply to certain selected coals, it may be doubted whether as much as 50 million tons per annum of *suitable* coal would be available. Secondly, supposing, for the sake of argument, that such sanguine yield assumptions are allowed, the 50 million tons of coal carbonized to produce 35 million tons of "semi-coke" per annum would yield *primarily*, say, 100 million gallons of petrol and 750 million gallons of fuel oil of inferior quality, or only about one-ninth of our present petrol, and about three-fourths only of our present fuel-oil, requirements. Were, however, the primary base and acid free oils to be hydrogenated (at further considerable cost), while about two-thirds of our present petrol requirements might be met, we would still remain completely dependent on foreign fuel-oil supplies. Thirdly, the idea of erecting new plant to carbonize 50 million tons of coal per annum, or three times the present carbonizing capacity of *all* the gas-works in Great Britain, seems fantastic. Fourthly, the transport of vast amounts of solid fuel of lower density than coal would involve formidable difficulties, especially in the Metropolis and other large cities. Lastly, while some people seem prepared to pay the present price of 55s. to 60s. per ton for "semi-coke," as against 35s. to 40s. per ton for good house coal, the majority, including myself, will probably not, and any attempt by Parliament to prohibit the use of raw coal in domestic fires will probably fail and bring the law into contempt. Perhaps a Cromwell might enforce it; but fortunately none of our "safety-first" brotherhood would be likely to do so. Hence, while recognizing that low-temperature carbonization has come to stay, and will play a useful, but subordinate, part in our national fuel policy, I cannot regard it as capable of materially solving our oil-from-coal problem, though it may help in a minor degree.

Hydrogenation.

If circumstances compelled the production of oil from coal, at present there seems only one way for it to be done with satisfactory yields—namely, by hydrogenation of the coal, a process which can also be extended to tars derived from it.

The process originated from the work of Bergius in Germany, where it was first developed by him, more particularly as applied to the brown coals which occur there. In 1927, however, after some preliminary trials had been made by the Fuel Research Board, Imperial Chemical Industries, Ltd., decided to explore thoroughly at their Billingham Works the technical and commercial possibilities of making petrol from British bituminous coals, and they are to be congratulated upon the brilliant technical success which they have attained.

By 1931, they had developed at Billingham a successful experimental plant capable of producing some 15 tons of petrol per diem from coal.

Now they are erecting, also at their Billingham Works, a large commercial plant estimated to be capable of producing 100,000 tons of first-grade petrol from about 146,000 tons of coal per annum, the total coal consumption in connection with the plant being estimated at about 365,000 tons per annum, the raising of which will employ some 1,500 persons at the collieries concerned. The thermal efficiency of the process will probably be about 40%, and it is anticipated that the inclusive cost will not exceed 7d. per gallon, though until after the plant has been in operation for some years, it is scarcely possible to say what the precise figure will be. The cost of the coal would be about 1·75d. and of labour probably about 1d. per gallon; but what the depreciation on such a plant will be can only be finally ascertained by actual experience, but it is bound to be heavy.

But even if the inclusive cost of production proves not to exceed 7d. per gallon, it is clear that in a free market petrol from coal could never compete with the imported natural product at anything like present c.i.f. prices, and as there seems little prospect of these materially increasing in the near future, the Government has recently announced that for a period of ten years it will guarantee a preference of 4d. per gallon to home-brewed petrol in regard to the duties imposed upon it and imported petrol. So it seems that petrol from coal is to be subsidized, not directly out of the Treasury, but at the expense of motorists and other petrol-users.

The new Billingham plant will, I believe, begin operating in about a year hence; and fuel technologists, generally, wish it all the success which its designers and owners deserve, and will await developments with the greatest interest. It is a wonderful large-scale experiment, the result of which will, I hope, more than justify its undertaking.

Assuming its anticipated technical success, the 100,000 tons of petrol per annum produced from coal would be equivalent to about one-thirtieth of our present total requirements, and assuming further a realized cost of production of 7d. per gallon, as against a c.i.f. price of 3d. per gallon for imported petrol, consumers thereof would be mulcted to the extent of £500,000 per annum, while the extra 1,500 miners employed would receive about £200,000 per annum in wages.

Here, I think, the matter should be left until the result of the experiment is fully known and the future trend of price for imported petrol can be forecasted. For how far the country would feel inclined or justified in subsidizing or protecting an uneconomic production of petrol from coal can only be answered in the light of future circumstances. Any policy of subsidies has obvious drawbacks and dangers from a national point of view; and in such connection it may be recalled that during ten years since 1924-5 our subsidized British beet-sugar industry has already cost the taxpayer some £40,000,000, and involved, besides, a loss of about £420,000 per annum in gross shipping earnings. We are also subsidizing corn and bacon by a policy which must force food prices above what they would be in a free market. When it is remembered that about two-thirds of the cost of producing coal at the pit-head consists of miners' wages, the rates of which must ultimately depend on food prices, it will be seen how impossible it is for us to have both dear food and cheap coal; indeed, the choice between them is the dilemma with which sooner or later, it seems to me, the country will be faced.

There is, however, one final consideration that should not be lost sight of. When rightly viewed, and in the long run, coal and oil are not so much competitive, as supplementary fuels. Nature has given us both abundantly, and it were folly not to make the best use of each. Here I largely agree with what Sir John Cadman said at a discussion on the subject at the British Association Meeting in London in 1931, at which I was present. He expressed the opinion that the future will probably see a gradual diminution in the competition between coal and oil and that their developments will be more co-ordinated. In some circumstances, and for certain purposes, it will be more economical to use coal than oil; in other circumstances, and for other purposes, the reverse will be true. The best policy for the nation is to impose no let or hindrance upon either being used in its proper circumstances, leaving the various issues, as they arise, to be determined without prejudice in the courts of science.

Institution of Gas Engineers

In this, our Third Institution Number, we publish the written contributions to the discussions, together with the authors' replies, on the papers presented at the Annual Meeting of the Institution of Gas Engineers, London, June 5-7. Our first Institution Number on May 30 contained the bulk of the papers, while in our issue for June 13 was the full report of the verbal discussions.

Town Gas in the Steel Industry

By Dr. H. ALEX FELLS, B.Sc., A.I.C., A.M.I.Min.E.,

Chief of Fuel Research Department, The Sheffield Gas Company.

Professor J. H. ANDREW, D.Sc. (Sheffield University), wrote: I have read Dr. H. A. Fells' Paper with very great interest, and agree largely with the views propounded by him, particularly with reference to the strong decarburization effect of moist hydrogen. I had ample opportunity of testing the furnace of the Sheffield Gas Company, and can most emphatically state that the decarburization effect in that furnace had been reduced to an almost unbelievable degree, this being largely due to the absorption of the moisture in incoming gas. It would be interesting to see what would be the effect of further dehydrating the gas, for example, if this was passed through silica gel one would expect even better results.

Another very interesting feature noticed was the extraordinary absence of grain growth obtained by heating this furnace as compared with others, and one began to wonder whether certain gases were effective in promoting grain growth.

I would like to suggest that the incorporation of a fan in the atmospheric system to ensure a positive pressure in the chamber—even when the doors were open—or, failing this, some form of gas curtain to burn the incoming air. It is possible, however, that this would create difficulties in the burner problems.

Dr. Fells and the Company with which he is associated have contributed to the Industry a method of heat treatment of the greatest value, which can only result in a better condition of the final product.

Mr. W. DIETERICHS (Gas Light and Coke Company) wrote: Dr. Fells is to be congratulated on presenting a very interesting and instructive Paper which demonstrates the important part which the gas undertakings of this country are playing in the struggle of the steel industry to re-establish its former pre-eminence.

The day has long gone by when steel products could be made by rule of thumb methods; the intense international competition of the present era has made it imperative to attain maximum efficiency, and this is only possible by the use of scientific control in every department of manufacture. This accurate control can best be achieved by the use of town gas.

Manufacturers are gradually coming to realize that the relatively high cost of town gas is, in many cases, more than offset by its numerous advantages as compared with other fuels, not the least of these advantages being, as Dr. Fells points out, the saving in wastage, due to the lower percentage of rejects, and the general raising of the standard in the quality of the products.

In the largest steel making plants it would be difficult for town gas to compete successfully with producer gas and blast furnace gas, but the thousands of firms, spread throughout the country, which re-heat and heat treat steel in the process of manufacture of their multitudinous products, offer a large potential load for town gas.

The new method of furnace atmosphere control which Dr. Fells describes is a notable advance in the technique of the steel industry, and should be a potent argument in favour of the use of town gas. It is evident that no other fuel in common use in this country can give a desired atmosphere with such precision, and as the good results following on this become known we may expect to see town gas obtaining a footing in works which are now using other fuels.

Bright Annealing.

Dr. F. HEATHCOAT (Rotherham) wrote: In dealing with the question of bright annealing Dr. Fells points out that town gas which has been previously submitted to pyrogenic decomposition provides a suitable atmosphere for this purpose. This method may have been used to remove what have been regarded as "undesirable constituents" in raw gas, but the underlying principles of the method appear to have been generally overlooked by those who have used this method in the past. The writer has recently investigated the method in some detail ("GAS JOURNAL," 2nd May, 1934).

The effect of pre-heating the gas is to remove oxygen, and to reduce the carbon dioxide and unsaturated hydrocarbons and to increase the ratio of H_2 to CH_4. This ratio should be greater for low carbon steels as compared with a lower ratio for high carbon steels in order to give an equilibrium atmosphere. It is important therefore that the pyrogenic decomposition should be controlled, and this can be achieved by varying the rate of flow in the pre-heating tubes. In the case of continuous strip annealing or normalizing an exact equilibrium is unnecessary as the time of treatment is short.

This principle has been applied by the writer to a continuous strip normalizing furnace operating at 980° C., and has successfully eliminated trouble due to carburization and carbon deposition. During a trial period of 873 working hours the total amount of gas passed through three muffle tubes was 25,320 cu.ft., and the quantity of carbon deposited during that time was only two ounces within the three tubes when a pre-heating tube was employed. It was calculated that this carbon deposition is only 0·6 per cent. of that which was obtained in the absence of the pre-heating tube. In addition therefore to giving a better product the method also results in a considerable saving in tubes.

Mr. C. S. SHAPLEY (Leeds) wrote: Dr. Fells deals with the requirements of a modern industrial fuel, and shows how town gas adequately fits these requirements. He then proceeds to discuss various methods of application of town gas to the steel industry, and describes furnaces used for billet heating, rolling, stamping, sheet heating, annealing, hardening, continuous furnaces, and tool treatment furnaces.

For billet heating, gas at 2s. per 1,000 cu.ft. appears to give satisfactory results. The Author shows that for drop stamping and forging some very good furnaces are available which are fitted with regenerators, generally of the chequered brickwork type, and high thermal efficiencies are obtained over long working periods.

Are the thermal efficiencies quoted in the Paper purely theoretical, or has Dr. Fells adopted a method of obtaining a practical thermal efficiency?

Some very interesting working cost results for oil and gas fired furnaces are given in Table VII. and on page 33, and the Author shows that business can be obtained for furnace work on cost basis alone, against oil at 58s. 6d.

per ton, if the price of gas is about 1s. to 1s. 2d. per 1,000 cu.ft.

Section II. is a very good technical section, in which the Author first stresses the very necessary factor of temperature control of furnaces to obtain satisfactory heat treatment. The major portion of the section deals with atmosphere control and the action of gases on the steels treated, from the point of view of scaling and decarburizing.

Formation of Scale.

The Author stresses the point that the most active scale forming medium at high temperatures is H_2O vapour, and that this medium is considerably more active than dry air containing its normal percentage of oxygen. Professor Cobb shows that with mixtures of CO_2, N_2, and H_2O vapour the scaling proportional to the H_2O vapour present, and that addition of unburnt gases does not materially affect the scaling property.

To obtain the best atmosphere for the minimum scaling effect, the burner must be carefully designed so that a real neutral atmosphere can be obtained, and the scaling properties materially reduced, although not eliminated.

The decarburizing of the surface of the steel during heat treatment and the resulting variation in its properties is fully outlined. It is shown that moist H_2 and CO_2 are active decarburizing gases and that a surface covering of scale usually inhibits decarburizing.

For bright steel annealing it is shown that to pass town gas through heat treatment tubes, to decompose the hydrocarbons, and then through the annealing muffle gives an atmosphere in which the work can be carried out satisfactorily.

The treatment of expensive high speed steels at 1,300° C. can be satisfactorily done in a furnace using a balanced atmosphere of cooled products of combustion and unburnt gases.

The Paper is extremely well compiled, and although dealing with problems in the main peculiar to the Sheffield district, it indicates what careful and accurate work is necessary when dealing with these complicated metallurgical problems.

Dr. M. B. Thompson (Rotherham) wrote: Metallurgists, as well as those more intimately connected with the Gas Industry as such, should be very much indebted to Dr. Fells for such a comprehensive survey of the present position and possibilities of the use of town gas in metallurgical processes. The question of the carburizing and decarburizing action of various gases on steel is one of special interest, and I venture to suggest that the action of nitrogen in this respect is still somewhat overlooked. In his survey of the factors contributing to decarburization, Dr. Fells states (p. 45), among the "facts on which there is most agreement," that pure nitrogen does not decarburize steel, but that commercial nitrogen does. It is a fact that Schultz and Hulsbruck, in 1927, claimed this to be so, but experiments carried out by Mr. H. H. Gray, M.Sc., A.I.C., and myself between 1927 and 1930 supplied ample evidence that pure nitrogen did decarburize steel, particularly between 750° C. and 900° C. This was confirmed both microscopically and by chemical analysis. Moreover, where high and low carbon material were heated in the same chamber in a nitrogen atmosphere, it was found that the low-carbon material could be carburized at the expense of the high-carbon material.

The microphotographs showing differences in grain size and phases present in samples of high speed steel would have been more instructive if more information had been supplied as to the rate and method of cooling the samples; moreover, it is not clear whether the four samples illustrated were actually taken from the same piece of metal—*i.e.*, from the same cast, or not. The suggested explanation of the difference in grain size is interesting, particularly that based on the heat of oxidation, and would appear to indicate the desirability of measuring, wherever practicable, the temperature by an optical pyrometer.

Effect of Atmosphere.

Dr. R. V. Wheeler (Sheffield University) wrote: The Sheffield Gas Company, through Dr. Fells, has rendered an important service to the steel industry in outlining some of its fuel problems, and in indicating that the avoidance of burning, scaling, and decarburization during the heating of steels may be of greater importance, from the economic point of view, than the thermal efficiency of the operations.

A few years ago, in connection with the problem of the production of smoke during certain metallurgical operations, a study was made in the Department of Fuel Technology of Sheffield University, by Dr. Fells and his present assistant, Mr. Robinson, of the effect of the character of the furnace atmosphere on its liability to cause the scaling and decarburization of different kinds of steels. The furnace for producing a "controlled" atmosphere, described by Dr. Fells, can be regarded as one of the practical results of that study. Apart from its technical importance, this furnace affords a good example of the application of a knowledge of fundamentals to the solution of an industrial problem.

The Sheffield Gas Company is to be complimented on realizing the value of engaging a staff of scientists to study the problems that arise during the development of the use of a particular form of fuel, and on so generously placing the knowledge so gained at the disposal of the steel industry.

Dr. H. Alex Fells, replying, wrote: Dr. C. M. Walter points out the difficulties of using a high grade gas, that is one of high calorific value, in the manufacture of steel in the open hearth furnace, and suggests that one of the causes of these difficulties is the high hydrogen content of such a gas and the resulting high water-vapour content of the products of combustion. He further suggests that the mixing of coke oven gas and blast furnace gas is done to obtain a calorific value of the mixture of 200-250 B.Th.U. per cubic foot, in order to produce the requisite volume sweep of hot gases in the furnace.

At present no coke oven gas is used undiluted in the manufacture of steel in open hearth furnaces in the Sheffield area. There are several reasons why coke oven gas is mixed with blast furnace gas for this particular operation, the principal one being that as open hearth furnaces at present in use have been specifically designed to use producer gas or blast furnace gas alone, both gases of low calorific value, the use of a higher calorific value gas would introduce many complications, notably in the proportioning of air and gas in the existing burner ports, in the correct combustion in the existing size of combustion chamber, and would have very particular effect in the correct functioning of the regenerator system. Changes in the total volume of products of combustion, and hence in the speed of the gases through the furnace and regenerators, and changes in the specific heat of the total mixture, &c., would all play their part in affecting the optimum operation of the existing type of open-hearth furnace.

Were open-hearth furnaces designed specifically to use a gas of high calorific value, it is probable that satisfactory functioning of such a furnace might be obtained.

Blast Furnace and Coke Oven Gas.

In using blast furnace gas and coke oven gas suitably mixed, considerable difficulty has been met both in this country and in Germany.

It has been found in practice that in using mixed coke oven gas and blast furnace gas, the same degree of luminosity of the flame was not obtained as obtains with producer gas. It has been suggested by German practice that increase in luminosity could be obtained by the addition of tar or tar-oil to the mixture, but more recent work has shown that by pre-heating the mixture of gases, the necessary luminosity of flame can be obtained, resulting in more rapid working of the furnace.

Concerning the probable action of the water-vapour produced by combustion of a gas rich in hydrogen, it is known that when blast furnace gas is used containing too much water-vapour, foaming of the charge is likely to occur, and it is probable that this may happen if a high hydrogen content fuel in the gaseous form were used, resulting in a high water vapour content of the gases in contact with the charge.

The use of mixed blast furnace and coke oven gas is dealt with in considerable detail by Heiligenstaedt[1], and by Bansen[2] and by W. J. Brooke.[3]

With regard to metal recuperators, their use can be recommended for both the built-in type and the external type. Furnaces are in use in the Sheffield area complete with built-in recuperators composed of heavily finned heat resisting steel pipes of rectangular section, built in the flues under the furnace. On the Continent much use is made of external metal recuperators, especially in furnaces of the continuous type using true diffusion flame principles where preheated air is essential to correct functioning.

Dr. Walter asks for particulars of the dimensions of the furnaces referred to in Tables IV. and VI., but the Author believes he intended to refer to Tables IV. and V., since Table VI. is referred to specifically later in the contribution. The heating chambers of the two furnaces were built to the same dimensions:

> 8 ft. 9 in. wide by 4 ft. 9 in. deep by 1 ft. 0 in. high to the spring of the arch by 2 ft. 6 in. high to the crown of the arch. The chamber is divided into two compartments by a sill, 9 in. wide by 6 in. high, each compartment then being 4 ft. 0 in. wide by 4 ft. 9 in. deep, by 1 ft. 0 in. high.

[1] W. Heiligenstaedt. Stahl und Eisen. 1928, Vol. 48, p. 1,465.
[2] H. Bansen. Stahl und Eisen, 1931, Vol. 51, p. 989.
[3] W. J. Brooke. Paper presented to the Iron and Steel Institute at the September meeting in Sheffield, 1933.

Details of the dimensions of the forged cranks or billets from which the stampings were produced are not to hand, but each crank weighed 71 lbs.

Disintegration of Regenerators.

The disintegration of brickwork regenerators due to the proximity of drop-hammers is usually experienced when insufficient attention has been given to the building of the foundation on which the hammer rests. In the case of large drop-hammers it is not unusual to have a foundation as deep as 30-40 feet, which assists greatly in limiting the possibility of damage to regenerator brickwork.

The Author has had no experience with the Chantraine type of furnace for sheet heating, but he can appreciate the possibilities of its use for this class of work.

The furnaces referred to in Table VI. were designed as oil-fired furnaces, and it should be mentioned that they were complete muffles. One of these furnaces was converted to use gas, by simply replacing the oil-burners with gas and air blast burners. Each furnace had a working hearth 6 ft. long by 4 ft. wide, and the height was 3 ft.

The oil burners were of the simple injector type, using fan-blown air at ½ lb. per square inch pressure, and a head of oil of 10-12 ft. The gas and air blast burners used air at ½ lb. pressure, and gas at 3 in. water pressure, the air and gas being controlled separately.

The contribution by Mr. G. J. Greenfield is very gratifying in that he remarks the appreciation by the Coke Oven Managers' Association of the efforts being made to forward the use of coke oven gas in the steel and metal industries. The field of application is wide, and as yet only a small area of it has been covered. It is hoped that the concerted efforts of the gas industry in all its branches and those of the producers of coke oven gas will yield very tangible results in the optimum utilization of the nation's fuel resources.

Prof. J. W. Cobb makes reference to the problem of smoke pollution caused by the use of smoky atmospheres in certain forms of furnace, and calls attention to interesting experiments carried out in the University of Leeds. In these experiments he was able to show that smoke, of itself, played no part in producing steel free from scale during heating. The Author, during the period he worked for the Sheffield and District Smoke Abatement Committee under Dr. R. V. Wheeler, had every facility offered to him by the Sheffield steel manufacturers to investigate this problem from the practical standpoint. Some of these manufacturers expended considerable amounts of time and money in seeking a solution of the smoke problem, and it is very gratifying to know that many of the processes where smoke was deemed to be essential are now being carried out by town gas. In the heating of steel sheets, a smoke laden atmosphere is still used, not that any virtue is claimed for the presence of the smoke, but that it indicates the presence of a heavily reducing atmosphere. In such gas fired furnaces this smoke and excess gas is consumed in the regenerators, thus obviating the nuisance of smoke pollution, and ensuring full use of the thermal value of the fuel being burned.

Action of Products of Combustion.

Prof. Cobb, in calling attention to the results of laboratory experimental work carried out by him and his collaborator, Mr. Preece, on the action on steel of products of combustion containing SO_2, introduces a subject of particular interest. Until quite recently, little knowledge of a quantitative nature has been available on this subject, although the influence of sulphur bearing fuels in the heating of steels has been appreciated for many years in the steel industry. The publication of Prof. Cobb's results will no doubt add considerably to the data at present available, and these results taken in conjunction with the knowledge at present being acquired by steel manufacturers who are using unpurified gas to a very considerable degree in the re-heating of heavy billets and forgings, will materially assist in arriving at a satisfactory solution of the sulphur problem. The question of the cost of purification either complete or partial, and the cost of distribution of purified or unpurified gas, will also need to be considered along with the matters to which reference has already been made, bearing in mind the important fact that it is as cheap a fuel as possible which is being demanded.

The reference to thermal efficiencies obtained in furnaces used for rolling mill operations, made by Mr. J. E. White, is of particular interest, in that it illustrates the advantages of preheating the air for combustion. The gas consumption of 3,377 cubic feet of gas per ton of steel heated, on a throughput of 430 tons per week indicates exceedingly good practice. This figure would suggest that the preheating of air is a better method of waste heat salvage than is preheating of the incoming steel load under these operating conditions. Naturally in making comparisons of gas consumptions per ton of steel output consideration should be given to the operating efficiency of the furnaces in question. The use made of the available capacity of a furnace has an important bearing on the thermal efficiency obtained, and only if two furnaces are being used to do the same weight of work in the same time can comparison of their thermal efficiencies be fairly realized.

In Table II. a gas consumption of 3,200 cu.ft. per ton of billets heated is given as the result of a test run of one day working at full capacity.

In the latest type of billet heating furnace referred to in the text of the Paper (p. 21) both load preheat and preheating of the air for combustion are used, and in that case a consumption of 2,580 cu.ft. of gas per ton of billets has been obtained. Comparing this figure of 2,580 cu.ft. per ton using air and load preheat, with the figure of 3,200 cu.ft. per ton using load preheat alone, it will be seen that the preheating of the air results in a saving of gas of 19·4%.

Colonel W. M. Carr regrets that he cannot agree with the summary of comparisons of gas and oil costs for heat treatment of forgings, and maintains that savings due to reduced scaling, reduced spoilage, &c., should be taken into account. Reference to the section of this reply dealing with the remarks of Dr. C. M. Walter will show that in the particular tests on which these comparisons were made, some of these savings incidental to the use of gas do not occur, since both the oil and gas furnaces were complete muffles. The tests were designed essentially to compare oil and gas on a thermal basis only, under comparable conditions of use. No doubt some explanation of the conditions of these tests might with advantage have been included in the text of the Paper.

The reply to the question by Mr. J. E. White of methods of determining thermal efficiencies of gas-fired furnaces will indicate to Mr. C. S. Shapley the factors used in arriving at the efficiency of a furnace. In practice there is only one satisfactory means of determining the thermal efficiency. A calculated efficiency based on the customary various heat losses of a furnace, the thermal capacity of the brickwork, &c., is of value in predicting the theoretical efficiency, but in works practice the ratio of the heat output in the form of B.Th.U. in the hot steel, to the B.Th.U. in the gas supplied, is the thermal efficiency used, that is, a practical efficiency. The thermal efficiencies quoted in the Paper are of this type. A calculated theoretical efficiency is of great importance in the original designing of a furnace, and in estimating its gas consumption, but when the furnace is in use it is the operating efficiency which is considered.

Competing with Producer Gas.

The difficulty of competing successfully with producer gas, referred to by Mr. W. Dieterichs, is naturally principally one of cost per therm, but in Sheffield we have been particularly successful in several instances of securing very heavy loads previously carried by producer gas. The policy of the Sheffield Gas Company of supplying gas in large quantities at thermally competitive prices with other fuels has been amply justified by the large increases in the industrial load to the largest steel firms in the city.

Dr. F. Heathcoat, by his contribution to the discussion on the subject of atmosphere control at comparatively low temperatures, makes a valuable addition to the knowledge of the fundamental principles underlying the practice of purging with raw gas.

The controversial question of decarburization by pure N_2 is again raised by Dr. M. B. Thompson, and he refers to the decarburizing effect he and his collaborator, Mr. H. H. Gray, found when investigating the problem on fundamental lines. The experimental methods used, and particularly the long period of heating employed, would no doubt give indication of chemical changes taking place, but in practice, the periods of heating at high temperatures being usually very much less than the five hours employed by them, and the marked effect of other gases present in the products of combustion, far outweigh the effects of the presence of nitrogen.

The four samples of heat-treated high speed steel shown in the Paper were taken from the same bar of steel, and all four specimens were given the same method and rate of cooling, that is, in oil. Actually, this control of grain size has been found in practice in the works to result with any composition or grade of high-speed steel.

It is particularly gratifying to be assured by such an authority on metallurgy as Professor J. H. Andrew that the claims made for the Atmosphere Control Process developed by the Sheffield Gas Company are justified. His suggestion that further dehydration of the waste flue gases by passage through silica gel might improve the process still further is probably correct. But the commercial attainment of such a degree of dehydration would probably impose so high an additional capital and operating expenditure that

the benefits which might accrue would not justify this extra cost. The suggestions that the incorporation of a fan in the atmosphere control system to ensure a positive pressure in the chamber even when the door is open and the use of a gas curtain at the mouth of the chamber have already been anticipated, and large atmosphere controlled furnaces are actually in use incorporating either a fan or a gas curtain. So far the use of both simultaneously has not been necessary. Actually a fan can only be used successfully in very large furnaces where the total volume of products of combustion is far in excess of the blowing capacity of the fan.

The work done by the Author and his assistant, Mr. Robinson, under the supervision of Dr. R. V. Wheeler, while working for the Sheffield and District Smoke Abatement Research Comittee, is referred to in the reply to Professor J. W. Cobb, regarding Industrial Smoke. The fundamental knowledge acquired during that period has been particularly advantageous in producing a practical solution to atmosphere control problems.

Production of Smokeless Fuel in Chamber Ovens at Medium Temperatures

By Eng.-Capt. J. FRASER SHAW, R.N. (Ret.),

Chief Engineer,

AND

Dr. J. G. KING, B.Sc., F.I.C.,

Chief Chemist, Fuel Research Station, Department of Scientific and Industrial Research.

Eng.-Capt. J. FRASER SHAW and Dr. J. G. KING, replying, wrote: The speakers seem to be in general agreement with us that the present is definitely the time in which to set about the manufacture of solid smokeless fuels. Mr. Gibson and Dr. Fishenden do not see how domestic coal can be entirely replaced by gas and agree that a large portion of the demand for smokeless fuel must be met by the supply of some suitable solid fuel. Mr. Hodsman and Mr. Cadman concur, the former pointing to coke-oven fuel and the latter to the experiments of Dr. Koppers at the Mines de Bruay.

There would seem to be some diversity of opinion, however, as to whether the solid smokeless fuel should be manufactured by the gas industry. Mr. Gibson shows by his pioneering work at Liverpool that he definitely does think so, but Mr. Roberts is not so sure. Both state that low-temperature carbonization does not interest the Industry because of the low yield of gas, and prefer the adaptation of gas works plant and of blending to give both a reasonable yield of gas and a reasonably combustible fuel. In offering this Paper to the Institution we do suggest that the gas industry should consider seriously the manufacture of combustible smokeless fuel. Gas undertakings are now preparing gas coke carefully for the open fire but it is admitted that the grate must be a special one to burn gas coke well. Would not the manufacture of a fuel sufficiently combustible for the ordinary open grate considerably widen the scope of their efforts? The manufacture of gas is not really so important since the demand for solid fuel might well increase more rapidly than that for gas, and a low yield in the first instance would be a help rather than a hindrance. We rather feel that plant designed for gas manufacture is not necessarily adaptable for making combustible smokeless fuel, and cannot fully agree with Mr. Roberts' claims in regard to blending. We do agree with him, however, that the use of rapid rates of coking with relatively high flue temperatures is one way of making good domestic coke. That is the means we have adopted in Part II. of the Paper. To this end we have used a plant designed for gas manufacture, but we feel that even better results are obtainable by using narrower ovens and higher rates of coking. Since writing the Paper we have conducted further experiments in silica ovens of less width, and have obtained some interesting data, which can be summarized as follows:

—	Mean Width of Oven. Ins.	Charge. Tons.	Time of Carbonization. Hours.	Rates. Inches per Hour.
1	2	3	4	5
Chamber oven . .	11	2	20	0·55
Silica ,, .	9½	1½	10	0·95
,, ,, .	6½	1	6	1·00

In order to achieve the higher rates of carbonization shown we have employed higher flue temperatures, and have been able to do so without overcoking the coke. The smokeless fuels produced at the higher rates were equally satisfactory from the point of view of ease of ignition and combustibility. It is our opinion that the gas engineer who wishes to make smokeless fuel would be well advised to develop on these lines rather than to strive to adapt plant designed for another purpose. Even these high rates of coking do not, however, achieve throughputs which compare with those which are made possible by continuous operation, as described in Part 1 of our Paper. The power to "pump" heat into the charge as it enters the top of a continuous retort is a most important factor and definitely supplies the difference in technique and treatment which Mr. Roberts does not recognize when he says that we have described one process, not two.

In introducing the Paper Capt. Shaw referred to the important question of testing the smokeless fuel. We have described our tests and find them satisfactory up to a point, but we feel that amplification is really necessary. With regard to the open-grate test we find that, while all the factors shown are equally important, ease of ignition is a property which requires careful definition. Gas coke, intended to be burned in special grates need not have this property to a high degree since the grate and a gas lighter overcome any reasonable disability. For the ordinary open fire, however, ease of ignition is important; we have found that a fuel which requires in our test more gas than 3·5 cu.ft. of 560 B.Th.U. gas will be difficult to ignite with sticks and paper. We have therefore aimed at a figure of about 2 cu.ft., which is appreciably lower than the 3·5 to 4·0 cu.ft. claimed by Mr. Gibson for his fuel. Dr. Fishenden, to whom the technique of our test method is due, states that she once thought ease of ignition to be of paramount importance, but that she now thinks low ash content even more important. She has referred to the ready ignitability of cinders and, with Dr. Lessing, feels that this well-known phenomenon contains a message to us in respect of the preparation of smokeless fuels. Microscopic examination of cinders suggests that the phenomenon is due to the presence in the cinders of innumerable thin fragments with sharp edges whose high accessibility to air make them ignite readily. It is possible, however, as Dr. Lessing points out, that the carbon of the cinders is activated or that the coal ash has a catalytic effect. The importance of the completeness of combustion of the coke is also emphasized by Dr. Fishenden; in this respect low-temperature fuels are superior to intermediate or high-temperature fuels. We feel that a special grate for the latter is a better remedy than using a small grate and a deep fuel bed. The high figure quoted by Mr. Hodsman of 69,000 special grates installed in London last year speaks for itself.

Mr. Hodsman points out that the ease of ignition of coke can be improved by giving it a skin of coal; it is our experience that the best "lighter" for a difficult coke, other than a gas flame, is charcoal. As little as four ounces is sufficient to start a fire with horizontal-retort gas coke.

With regard to other properties, Mr. Gibson and Mr. Hodsman both refer to density. This is a difficult question; high density means less transport cost and less handling, and would seem to be desirable, given the same general combustibility. For closed stoves high density is definitely preferable.

Dr. Lessing has raised the question of the importance of volatile matter and this is a little difficult to answer. A high percentage of volatile matter means a longer flame and this is helpful where, as Mr. Cadman points out, a long flame is wanted in a kitchen range.

Experiments have been carried out at the Fuel Research Station upon cokes which have approximately the same structure, but which contain different amounts of volatile matter. A coke containing 8·5 per cent. volatile matter was better than that containing 2·7 per cent. in that

(i) it burned up more rapidly;
(ii) it gave a more intense fire;
(iii) it gave distinctly longer, non-luminous flames which increased the draught through the fuel bed.

It is our general opinion that smokeless fuel must contain a certain minimum of volatile matter and that this should be distributed as uniformly as possible through the fuel. The minimum would seem to be about 4-5 per cent.

Aspects of Benzole Recovery and Refining

By S. W. A. WIKNER, F.I.C.,

By-Products Works Manager, Newcastle-upon-Tyne and Gateshead Gas Company,

AND

B. RICHARDSON,

Technical Superintendent, Newcastle-upon-Tyne and Gateshead Gas Company.

Mr. W. A. DAMON (H.M. Chief Inspector of Alkali, &c., Works) wrote: With reference to the augmented quantity of sulphuretted hydrogen evolved on neutralization of a xanthate which has been kept for some time, I too have come to a similar conclusion as a result of experiments made in this laboratory by my assistant Mr. Brookhouse. It appears that xanthate decomposes rapidly in the presence of excess caustic soda with the formation of sodium sulphide and sodium carbonate, the reaction slowing down as the caustic soda becomes exhausted. Xanthate free from excess soda is comparatively stable, little or no change in the iodine value being noted up to a period of more than two months.

It would appear probable that an alkaline xanthate could be stabilized by putting back into it crude carbon disulphide from a previous batch.

A secondary but much slower decomposition occurs in a neutral xanthate. In this case the sulphur of the xanthate reacts yielding methyl mercaptan which is doubtless responsible for the malodour to which the authors refer. The presence of this compound can be demonstrated by the isatin reaction.

Mr. ALEXANDER MACKAY (Stoke-on-Trent) wrote: The authors are to be highly congratulated on presenting a Paper at a most opportune time, when many of the medium and larger gas undertakings throughout the country are considering extensions to their benzole recovery plants, or in some cases contemplating the commencement of benzole extraction. The authors' results and investigations will no doubt be of considerable assistance, and I am sure it will prove a valuable reference for some time to come.

Early in February we commenced benzole recovery from mixed purified gas, chiefly vertical and horizontal with a smaller proportion of carburetted water gas, and the yields have been exceptionally good, the average being 3·6 gallons per ton of coal carbonized, with a quality at 75 per cent. at 120° C. (Retort Test) or equivalent to over 4·0 gallons per ton when calculated on the basis of 65's. Whilst it is too early to put forward a true balance-sheet showing the actual economics of benzole extraction in our case, I would state that the revenue derived from the sales of benzole over this short period exceeds 50 per cent. of the total cost of the plant which includes a refining section and provision for the housing of the plant, &c.

We have consistently extracted 93 per cent. of the total naphthalene by adopting benzole stripping with a final figure of 0·5 to 0·75 grain per 100 cu.ft., but naphthalene complaints increased abnormally a few weeks after the plant was started. These are approaching an average level and I trust will eventually disappear. To counteract the removal of lighter oils which have generally deposited in the high and low pressure trunk mains, a small oil atomizing plant was erected and gas oil is continually sprayed into the mains, which forms an oil film and deters internal corrosion besides assisting in the removal of traces of naphthalene. The authors' method of removing the residual naphthalene is probably more efficient but I would suggest where steel mains run direct from the works that oil atomization is well worth the small expense involved in running and the initial outlay.

Regarding steam consumption the authors' figure of 74·9 lbs. per gallon of benzole appears excessive as against our recorded figure of 39·2 lbs., but this is probably accounted for by the increased yield per ton of coal in our case, although the oil circulation per ton of coal carbonized varies between 120 to 140 gallons.

Acidity Trouble.

Mr. F. NICHOLLS (Gateshead-on-Tyne) wrote: The authors are fortunate in having no trouble with acidity of the rectified benzole. I have tried several methods, including shorter acid wash, placing alkali in the washed storage tanks, feeding it into the stills and separators, &c., but all these methods—whether tried on the full-scale or laboratory basis—proved ineffective. In every case acidity appeared as soon as a distillation temperature of 105-110° C. was reached. Others with whom I have discussed the matter have either been fortunate in being free of acidity or unfortunate in having it present, but I have failed to discover a case where acidity has given trouble and then been cured by some specific action. Can the authors give any assistance in this matter? I have obtained relief only by subjecting the rectified benzole to two or three water washings with a fine water spray after completion of manufacture.

I note that corrosion occurred (page 24) but there was no acidity of the benzole. Neither or both might be expected but it is surprising to learn that one was present without the other.

From experience with a rectifying plant dealing with up to 3,000 gallons of crude per day I can confirm on a full scale basis the interesting laboratory experiments dealt with on pages 28-30, showing the difficulty of removing CS_2 by distillation methods. Concentration of the forerunnings was abandoned owing to its definitely unhealthy nature and the large amount of uncondensable vapours produced.

I have no experience of the Methanol process but would like a little more light on the matters dealt with on pages 31 and 32. If the chemical equation given adequately represents the process then the sulphur removed per c.c. or gram of reagent used would appear to be 0·8 gram instead of 1·6 as given in the Paper. In this case the actual efficiencies are much nearer theoretical than that for which they are given credit.

It is open to argument whether the method of assessing efficiencies given in Table XI. is sound—or whether some of the high efficiencies claimed are only the purely arithmetical effect of dividing the *total* sulphur removed by the small amount of *one* reagent used.

The figure of 1·48 therms per gallon given on page 10 is of theoretical interest, but in day to day working only the gross gallonage of crude benzole is known. Hence the figure 1·3 obtained by dividing 102,000 therms by 77,644 gallons is of more practical use for determining the credit to be given to the retort house for each gallon removed of the particular quality made (78·5 per cent.). Making 60 per cent. crude I have obtained a figure of one therm per gallon of crude. Assuming the difference in quality is due simply to the different proportion of wash oil present, this figure is in agreement, by direct proportion, with the 1·3 therms to be credited to the retort house for each gallon of crude benzole made, when the quality is, say, 78·5 per cent. For other qualities of benzole the corresponding figure is easily obtained on the assumption mentioned above.

What is the experience of the authors with automatic devices, and are such plants as automatic as the makers claim?

The later plants make a high quality benzole—say, 90 per cent. or more. Is there any special advantage in this? Or do the authors consider that savings in carriage are offset by

(*a*) reduced revenue per unit on the sliding scale of payment;
(*b*) difficulty of disposing of the naphthalene fraction?

Sludging of Gas Oil.

In their freedom from wash oil troubles the experience of the authors is unusual, as most people have considerable trouble with sludging of gas oil. Thickening of creosote oil is a drawback to efficient distribution in tower scrubbers, but plant deposits are generally of a soft variety and removable fairly easily with compressed air. I have found that sludging of gas oil which was moderate on a benzole plant alone, was very much accentuated with the installation of naphthalene washers of the brush type where the used oil was fed to the benzole plant oil circulation. Emulsion contained 60-80 per cent. water and about 20-40 per cent. oil, and was easily resolved by heating to water and oil except for a few per cent. of a hard gritty substance. This caused considerable trouble in the benzole plant, was difficult to remove, and has even blocked 4-in. pipes solid.

Tar fog would hardly explain this seeing that the gas was purified and also oil-washed for benzole before entering the naphthalene washers.

Gas oil is very suitable for use on tower scrubbers, but if benzole washers of the brush type are available there is much to be said for creosote. After an experience of 3-4 years creosote washing and 10-11 years gas oil washing I am not altogether sure that gas oil is the more convenient washing medium.

The authors' freedom from sludging troubles is probably

bound up with the trend of design in modern benzole plants. In the design of the earlier plants the importance of cooling the wash oil was recognized and provision was made for heat interchangers and a large stock of oil in circulation, requiring generous tank accommodation. In the modern plant everything is subordinated to making the plant automatic and dispensing with labour. Hence tanks have been reduced to a minimum and the stock of wash oil is very small.

In the authors' plant the oil stock is only some 4,000 gallons. But according to Table VI. the addition of oil in a year to replace that sent away in the crude benzole was nearly 12,000 gallons. Hence at the end of a year's working only 20-30 per cent. of the original oil could have been present in the plant, and it would seem that freedom from sludge troubles was due simply to the fact that for the bulk of the year the wash oil in stock was comparatively fresh.

If a rectifying plant had been included and the gas oil recovered from the crude benzole returned to circulation, it is likely that the authors would have had reason to revise their opinions very considerably.

Following on this change in design some plants, as at North Shields, have no oil heat interchangers. This means that more steam is required to heat up the oil and more water to cool it after treatment in the still. In many works there is no provision for separate measurement of steam and water used on the benzole plant and charges under these heads are apt to be much higher than imagined—especially seeing that some 40-50 gallons of wash oil must be heated and cooled for every gallon of crude benzole made.

Hence the figures given for steam consumption are particularly interesting, being higher than those of Hollings and Hay who presumably had the benefit of heat interchangers.

Unfortunately no figures are available for water consumption. On a plant operated by the writer the cooling, though better than that obtained at North Shields, is far from ideal. Yet the amount of water used is such that if taken from the Water Company's mains at 8d. a thousand gallons, the cost would exceed the wages of the full-time attendant on the benzole plant.

Hence prospective purchasers of a benzole plant, in falling for the " bait " of an automatic plant run without labour, may all unknowingly be led into paying in increased steam and water charges more than they " save " on labour owing to the charges under these heads being hidden in the works totals for steam and water.

The Process at Hampton Court.

Mr. C. T. PRICE (Hampton Court) wrote: I have extracted very valuable information from Mr. Wikner's and Mr. Richardson's communication, and I should like to compliment them for presenting such a comprehensive paper on this important subject when it was most needed, and perhaps a few particulars of the methods in use at Hampton Court may be useful to the discussion.

As the process at Hampton Court is different from the majority of plants in this country, some remarks relative to these operations may be of interest.

The gas from both horizontal and vertical retorts is washed after purification in a Holmes static brush washer with gas oil, and the resultant benzolized oil is treated in a Thorncliffe type benzole plant erected by Newton Chambers. The basis of the design of this plant is the continuous adaptation of the well-established intermittent system of producing washable product by " once running " the crude condensate from the wash oil stripping still. Thus with such plants a product of any desired quality can be produced which is absolutely free from wash oil contamination.

With benzole plants of the continuous fractionation type the vapours to be fractionated consist of a mixture of benzole, naphthalene, naphtha, and wash oil in certain proportions together with the steam introduced at the base of the wash oil stripping still. The efficiency of fractionation of this mixture of vapours is dependent upon the quantity of steam present—*i.e.*, when the water vapour content is low, efficiency is relatively high, and *vice versa;* therefore with this continuous fractionation type of plant it is necessary to limit the steam supply to the wash oil still with consequent reduction in stripping efficiency. This results in lower efficiency of extraction in the gas scrubber due to the return oil not being completely debenzolized.

The Thorncliffe type plant results in maximum scrubbing efficiency in the gas scrubber because the debenzolized oil is completely stripped of its benzole, due to the fact that the requisite amount of steam can be admitted to the wash oil still without affecting the quality of the finished benzole product.

With regard to quality of spirit produced, we have proved the plant is capable of producing practically any quality up to 93 per cent. at 120° C. (Retort Test).

In the early stages of working, wash oil was added to the washer to compensate for wastage at the rate of about 0·12 gallon per gallon of benzole made. For some months past, however, we have continuously returned the naphtha fraction to the debenzolized oil on its way back to the washer. By working in this way the wash oil becomes saturated with the heavier hydrocarbons, which, after a time does not extract any more from the gas, and they then pass on through the gas scrubber without being absorbed by the wash oil. The absorptive capacity of the wash oil for benzole is not impaired by its naphtha content, and we consider that it is more remunerative to utilize the calorific value of the naphtha in the gaseous form than to market it in the liquid state.

During the last two months no gas oil has been added to the washer and the stock of naphtha in the storage tanks shows a slight loss equal to 0·024 gallon per gallon of benzole made, the level of oil in the washer remaining stationary.

By returning the naphtha to the wash oil we tend to keep the free carbon content of the wash oil low and loss of efficiency due to sludging has not yet been experienced, possibly due to this process. The quantity of benzole extracted during this period is 2·25 gallons per ton of coal carbonized, the gravity being 0·867 and the quality 82·2 per cent. at 120° C. (Retort Test).

With regard to naphthalene extraction. No naphthalene passes the washer, and there is no appreciable quantity of naphthalene in the wash oil. It is inevitable therefore that the naphthalene content of the naphtha will gradually increase until the saturation point is reached when naphthalene will settle and solidify at the bottom of the storage tank.

There appears to be no reason why we should not continue to add the supernatant naphtha to the debenzolized wash oil as the efficiency of naphthalene extraction from the gas will be unaffected to any appreciable degree because of the high rate of oil circulation through the scrubber. At any rate, the labour of fetching and carrying and adding gas oil to the washer has been eliminated, the disposal of the spent oil to water gas plant or tar well avoided, and other advantages have been obtained, and, in addition, the 10 per cent. of crude benzole which consisted of products derived from cracking of the wash oil is no longer produced.

We agree with the authors when they say that the efficiency of naphthalene extraction is not dependent on the length of time the oil remains in circulation.

With regard to labour and other charges, these consist of pumping a small quantity of naphtha to an overhead feed tank, the reading of temperature and pressure dials once hourly, and the collection of a sample for an average test. All cooling water used on the plant passes under mains pressure through the benzole and oil cooler, and by gravity to the works boiler feed tank, and a close watch is kept on this latter tank for any leakage which might occur from the oil to the water ways on the benzole plant. No pumping charges are incurred.

With regard to the refining of the crude benzole by the acid washing or other process, will the authors of the Paper be good enough to give some approximate costs?

From the refining point of view, assuming a benzole with a specific gravity of about 0·867 and a sulphur content of less than 1 per cent., what quality of crude benzole at 120° C. is the most economical one to produce?

Need for Scientific Examination.

Mr. S. W. A. WIKNER and Mr. B. RICHARDSON, replying, wrote: We note that the majority of speakers have not found gas oil an unqualified success when employed for benzole extraction, and in several cases trouble in the shape of heavy sludge deposits and oil-water emulsions has arisen after the oil has been in use for a relatively short period.

The suggestion of Dr. Lessing that the time is opportune for the scientific examination of benzole wash oils on comparative lines, preferably by one of the Research Committees of the Institution, is worthy of careful attention. Certainly there is much still to learn concerning their chemical properties and constitutions.

It seems probable that difficulties due to sludging and the deposition of pitch and carbonaceous matter in the washers and scrubbers related by Colonel Carr are due to changes in composition of the wash oil itself resulting in the formation of insoluble pitch-like compounds and a certain amount of carbonaceous material. This tendency to decompose and polymerize would certainly be accelerated if a proportion of the " cracked residues " had been included in the fresh gas oil, and we are pleased to note that the experience of Mr. Thorman appears to bear this out. We also agree with Mr. Thorman that the type of carbonizing plant in use has some influence upon the behaviour of the gas oil. The presence of tar fog—even in minute

quantities—is detrimental and its complete removal from the gas prior to the benzole recovery plant is most essential if smooth working is to take place.

It appears to us that the formation of an emulsion of oil and water depends upon the presence of solid suspended matter in the wash oil, and that once insoluble carbonaceous material (such as the carbonaceous scale described by Colonel Carr) appears, emulsification is almost bound to follow.

Mr. F. Nicholls describes an emulsion obtained from a rotary brush type of washer which contained a few per cent. of a hardy gritty material. We consider that this substance, albeit present in so small a quantity, played the major part in causing emulsification. For this reason we think it is important to ensure that wash oil storage tanks are adequately protected from the ingress of foreign matter such as coke or coal dust by keeping manhole covers in position.

We agree with Mr. Nicholls that emulsification is more likely to occur in a scrubber of the rotary type than in tower scrubbers, since the "churning" action of the rotating brushes of the former upon the oil and condensed water is absent in tower scrubbers.

It may be noted, however, that for some months at North Shields the oil used from the benzole plant was circulated through a rotary brush scrubber before passage to the tower scrubbers and that although water accumulated in the compartments of this and was run off each day there was no sign of emulsion, the line of separation between water and oil being clearly marked.

Part of the freedom from sludge and emulsion at North Shields may be due, as suggested by Mr. Nicholls, to the small oil stock carried, and that during the course of the year replacement maintained the wash oil stock comparatively fresh.

Mr. Nicholls further states that if rectifying plant has been included and the gas oil recovered from the crude benzole returned to circulation results might not have been so favourable. On the other hand, Mr. C. Price in his interesting communication attributes the freedom from sludge and emulsion on the Hampton Court benzole recovery plant to the system there adopted of returning the naphtha fraction to the debenzolized oil. Both Colonel Carr and Mr. Holton have used a spindle oil with excellent results. We have conducted laboratory experiments with a similar type of oil and can testify to its suitability as a medium for benzole extraction. We have not found, however, that the sulphur content of gas oil increased in use to such an extent as to exercise an adverse effect upon the benzole recovery as apparently is the experience of Mr. A. L. Holton.

Mr. Firth has found creosote oil satisfactory and cites its superior absorptive properties for benzole vapour as a recommendation. If creosote be employed a proportion of gas oil must still be used in order to free the stripped gas of naphthalene, and our experience has been that creosote oil requires much more frequent renewal than gas oil. Whilst acknowledging that creosote is a home-produced product our considered opinion is that the advantages of using a straight-run gas oil, or a spindle oil are such as to more than outweigh this consideration.

Oil Atomization.

Both Mr. Firth and Mr. Mackay spray gas oil into the gas stream with a view to preventing trouble from naphthalene deposits. Such a system is undoubtedly cheap, and we agree with Mr. Mackay that when steel mains run direct from the Works, oil atomization is worth while, though we consider that the most satisfactory method to ensure complete freedom from naphthalene is entirely to remove the compound from the gas on the Works.

The gallonage of benzole recovered by Mr. Mackay seems exceptionally good. At the Newcastle Works, when gas is manufactured from Durham coals, it is difficult to obtain more than 2·8 gallons of benzole per ton testing at the figure given by Mr. Mackay. It would have been of interest if the specific gravity of the benzole had been included seeing that a proportion of it was derived from continuous vertical retorts and a further small portion from carburetted water gas.

We are pleased to note that Mr. Firth has obtained a figure for the reduction in sulphur content of the gas which is in fair agreement with ours. It is, however, essential that benzole washing should be carried to the limit, for if only a portion is recovered by circulating an insufficiency of wash oil, less sulphur-containing compounds will be removed per cubic foot of gas.

Mr. H. Hollings suggests that economy in steam consumption on the North Shields benzole plant might have been obtained if the exhaust steam from the pumps had been utilized in preheating the benzolized oil. This method of making use of waste heat has actually been considered and will probably be adopted. We agree with Mr. Thorman that outlay on cooling plant is better repaid than the provision of extra heat exchangers, because the cooler the oil the less there is to be circulated, heated, and cooled.

In reply to Mr. Nicholls' query as to whether it is advantageous to produce a high grade crude benzole or not under the present sliding scale of payment there is little difference either way. Whether or not it is advantageous to sell the higher grade product depends upon the composition of the naphthalene oil fractions. If these contain appreciable volumes of low boiling oils it is worth while disposing of them in the crude benzole, but on the other hand if the dephlegmator is efficient and the oils consist essentially of naphthalene and wash oil residues, then we consider that it is best to return them to the wash oil circulating system.

Automatic Control.

Regarding automatic control for benzole plants, there is a danger in some quarters of making a fetish of this feature. Our experience of such control has not been such as to allow us to recommend it unreservedly. By the installation of automatic control an extra outlay equivalent to four or five years' supervision may, in certain circumstances, be incurred, and we agree entirely with Mr. Nicholls when he says that purchasers of automatic plants may be led into paying more for steam and water than is saved in labour.

We note with interest that several speakers allude to the fact that benzole recovery is a paying proposition and we can endorse Mr. Firth's statement that it is difficult to show a saving in Works expenses when the plant is laid off for a period, which fact indicates how little costs are increased when benzole recovery is adopted.

Mr. Firth raises an interesting theoretical point on the carbonizing side by suggesting that the increased gas evolution which takes place when heavier charges are laid in horizontal retorts brings about a greater chilling effect on the inside walls than in the case of light charges, and it is this fact together with shorter contact time which is responsible for the higher paraffin content of the benzole. Our statement that time contact appears to exert more effect than temperature is based on the observation that the paraffin content of benzoles produced from well-filled retorts of the same dimensions is practically the same whether the combustion chamber temperature is 1,270° C. or 1,400° C.

It is unfortunately true, as suggested by Mr. Thorman, that in certain cases of benzoles containing appreciable amounts of thiophene the advantages of adopting the inhibitor process may be arguable. The excess of thiophene must be removed by working with strong acid, but if the carbon disulphide can be eliminated a less drastic acid wash will suffice with, probably, only partial destruction of unsaturateds. In practice the requisite amount of thiophene may be removed by a modified wash of the whole or complete removal of the thiophene effected from a portion of the benzole.

Replying to the query of Mr. Firth with regard to the probable increased loss, by washing crude benzole instead of the once-run, we consider that the loss is not of much consequence, as indicated by the low acid consumption and small loss in washing found in practice. On the other hand, the saving in plant and operation is material.

No trouble with emulsion has been experienced during the acid wash and subsequent water washes even when dealing with 65 per cent. crude benzole. Mr. Firth's experience in working the methanol process is of much interest as are the means adopted for overcoming difficulties, which it is to be noted have not occurred in connection with the process as worked by us. Emulsification of the xanthate solution only occurred when strong acid had been used in the benzole. It has been found that emulsification of the xanthate may be caused by traces of acid tar remaining in the washer from a previous charge.

Use of Alkalinated Cellulose.

Dr. Lessing's reference to the use of alkalinated cellulose for removal of carbon disulphide is of interest to the authors, one of whom spent much time recently investigating this reaction, without, however, any measure of success.

At the low concentration of carbon disulphide in the benzole the reaction proceeds very slowly and with poor efficiency. As removal of thiophene is attended by loss of unsaturateds the Industry requires to-day that elimination of carbon disulphide must be substantially complete. The use of the viscose process, therefore, does not appear to be promising.

With regard to the use of ring-packed columns it seems rational to assume that the smaller the size of ring the better the fractionation and generally, a compromise is arrived at between the cost of packing and its efficiency. Probably the best result at the lowest cost will be obtained by a scientific grading of size from large rings at the bottom to small ones at the top of the column.

In reply to Mr. A. L. Holton we are unable to suggest a

means whereby the " gassy " smell of crude benzole may be removed or masked. It should be remarked that the use of crude benzole as a motor fuel is attended by some risk of gum formation in the carburettor or induction of the engine. Freshly made crude benzole is free from gum, but if kept for some time gum may be produced unless inhibition is effected by the fortuitous presence of tar acids in the benzole.

With regard to Mr. Nicholls' query, acidity in benzole can be corrected by treatment with caustic soda solution, which may be conveniently carried out in the receiving tank. Alternatively benzole vapour from the still may be bubbled through hot caustic soda solution, a method now operated in some Works.

Our experience of corrosion occurring with benzole which has passed the standard test for acidity is not unusual. An acidity too slight to affect the test may possibly over a long period cause corrosion. The corrosion itself will reduce the acidity of the benzole and there is a further possibility that the corrosion may not necessarily be due to acidity.

Regarding the methanol reaction, this is correctly represented by the chemical equation given. Possibly it should have been made clearer that one gram of caustic and one cubic centimetre of methanol together should theoretically remove 1·6 grams of sulphur. The reaction proceeds only in the presence of both reagents and the object of the investigation was to ascertain the effect of varying the proportion of each.

Mr. Price asks for approximate costs of the benzole refining processes, but these depend so largely upon a number of varying factors such as, for example, the quality and quantity of benzole treated, the type of refining plant, &c., that it would be difficult, if not impossible, to give representative figures capable of general application.

The experience related by Mr. Damon, who gives a definite lead as to means whereby xanthate may be stabilized, is, in our opinion, of considerable importance in view of the possibility that the treatment of xanthate may, as suggested by Mr. Firth, eventually be carried out at a central recovery plant. In this event a satisfactory method of retarding the decomposition of xanthate solution will be needed.

Impressions of the Gas Industry in Canada and the United States of America

1—Gas Production

By Col. W. MONCRIEFF CARR, O.B.E., T.D.,

Engineer, General Manager and Clerk, Stretford and District Gas Board.

Dr. G. E. FOXWELL (London) wrote: Colonel Carr has mentioned the Thylox process, but does not speak of its applicability to England. The process has many attractive features, not the least of which is the removal of between 95 per cent. and 100 per cent.—the precise extent depending on policy—of the H_2S contained in the gas by a continuous washing process. A certain amount, probably some 40 per cent., of the CS_2 and other sulphur compounds are also removed. In addition practically the whole of the cyanides are extracted from the gas—a factor of some importance. The gas is washed with a solution of ammonium dithioarsenate, as a result of which an atom of oxygen in this compound is replaced by an atom of sulphur. The washing solution is then regenerated by simple aeration in a tower and the sulphur is precipitated, the original washing compounds being regenerated. The sulphur is removed as a froth at the top of the tower, and can be sold after purification at a price at least as high as that of imported rock sulphur. For some reason, with which I am not acquainted, Thylox sulphur in Germany commands a higher price than the imported article. It is probable that British conditions would require a small oxide catch box to follow the washing towers, even if the plant were designed for 100 per cent. extraction, but even when the cost of this is taken into account the economies of the Thylox process are such that the cost per 1,000 cu.ft. of gas is far below the cost of removing sulphur by the oxide process. The complete removal of the cyanides, moreover, allows any oxide catch boxes that may be necessary to operate very smoothly.

The Thylox process is not in any sense of the word experimental, as in addition to the plant mentioned by Colonel Carr as operating in America, there are installations, some at work and one under erection for the Ruhrgas A.G. in Germany having an aggregate capacity of some 65 mn. cu.ft. of gas per day.

The Thylox process appears to me to have undoubted advantages for British gas works, in view of its low operating costs and of the relatively small amount of ground space occupied. In its present form it is probably suitable for works making more than 100 mn. cu.ft. of gas per year.

Col. Carr's Reply.

Colonel W. M. CARR, O.B.E., T.D., replying, wrote: Mr. Briggs' question as to why a smaller percentage of the total population in the United States of America are consumers of gas was answered by Mr. Richards who called attention to the relatively much larger agricultural and rural population out of reach of the gas supply. I would like to add that my impression is that gas is just as much used and appreciated by the working classes of America as it is by those in this country.

The comparative figures of consumption per consumer given on pages 4 and 5 of the Paper refer to manufactured gas only, and if natural gas is included, the consumption of gas per consumer including industrial gas in the United States is approximately eight times as much as in Great Britain. In considering the decrease in gas consumption in the United States as between 1929 and 1932, upon which Mr. Clegg asked a question, one must appreciate the effect of the depression referred to by Mr. Canning. The general average reduction in industrial production in consequence of the depression is stated to be something over 50 per cent.

The main purpose of mixing natural gas for town supply, as for example in Chicago and St. Louis county, is to provide as indicated in Mr. O. R. Allgeiers' paper (see Appendix 1), a gas which can be substituted by all manufactured gas from standby plant in the event of failure of natural gas supplies brought from far distant gas fields. In addition, mixing is necessary to permit of the use of manufactured gas from coke ovens which are operated in accordance with the market demand for coke, or from by-product coke ovens operated in connection with steel works. A further reason for mixing is that it is found that gas of 800 B.Th.U. per cu.ft. is easier of utilization in domestic appliances. The automatically controlled mixing plants can be operated to produce remarkably constant conditions as is indicated by the calorimeter charts reproduced on Plate III. in Mr. Allgeiers' paper.

Mr. Briggs' question on distribution pressures and gumming is answered in Mr. Masterman's paper. Feeder mains carry high pressures from 5 to 20 lbs. per sq. in. and these are governed down on the low pressure system to from 5 in. to 10 in.

An interesting paper entitled " The Gum Problem—Recent Developments " was submitted by Mr. W. H. Fulweiler at the American Gas Association Meeting at Chicago.

Mr. Richards kindly replied to the questions raised by Mr. Briggs and Mr. Clegg on the practice of installing waste heat boilers on the producer gas supply to coke ovens as a means of cooling prior to cleaning. The effect of the use of clean heating gas as a means of extending the life of refractories has been definitely established in coke oven practice, and is worthy of consideration in retorting practice. It is, after all, a question of balancing saving in maintenance against increased first cost.

I have also to thank Mr. Richards for his reply to Mr. Briggs' question with regard to mixing coal and breeze before carbonizing, a practice which has been extensively adopted in American coke ovens.

Oil Gas from Verticals.

Mr. Briggs asks if the production of oil gas in vertical retorts as a means of enriching coal gas has been successful. The process is, I understand, in operation at several works. At Pawtucket in an installation of 5 beds of 8 Glover-West vertical retorts set 4 in a row, one end retort is used for oil gas production and has been found sufficient to distill sufficient oil to increase the calorific value of all the gas pro-

duced in the retort bench from 495 B.Th.U. without oil to 515 B.Th.U. with oil.

I referred, when introducing the Paper, to the work carried out at H.M. Fuel Research Station in the production of oil gas in vertical retorts on the suggestion of Mr. S. Tagg when President of the Institution, the results of which were published by the Board in Technical Paper No. 14 in 1925. In these experiments, the oil utilized was approximately 0·776 gallon per therm of increased thermal yield, which is rather better than the yield obtained under normal conditions in America.

Mr. Canning asked about the figure of capital employed in the Ontario Natural Gas Fields, approximately 43 million dollars. This figure which is relatively high on account of the multiplicity of wells in one reservoir, includes cost of sinking wells and distribution systems. I regret that I am unable to say what provision is made for the writing-off of capital as wells are exhausted. Carbonizing plant is already installed in many towns in Ontario and will eventually take up the natural gas load, although new wells are still being sunk in all parts of the province to maintain supplies, the new development being most extensive on the western side.

Mr. Canning further asked about the changer-over in Chicago from manufactured gas of 530 B.Th.U. to mixed natural and manufactured gas of 800 B.Th.U. I understand that the change-over was made progressively in sections of the area so that apparatus could be adjusted with the minimum of inconvenience to consumers.

Mr. Clegg asked the capital costs of producing natural gas. I believe that many engineers engaged in its production would find great difficulty in answering this question. Sources of supply diminish as withdrawals occur and gas wells fail without warning so that the availability of supply must be developed to exceed the peak demand. I referred to the question of expensive overdevelopment and Mr. J. H. Dunn in his paper at the American Gas Association Meeting in Chicago states:

> "Our various State laws, rules, and regulations up to this time have failed to provide for an orderly development of gas fields which would be practical, economical, and equitable to all concerned. Although the solution of this problem is difficult and involved, the gas company or the individual, whose business it is to produce natural gas, will, in the absence of a remedy, be required to make excessive investments, resulting in excessive cost of production of a given quantity of gas from any separate source."

No Compressed Natural Gas.

Replying to Mr. Clegg's further questions, I have no knowledge that compressed natural gas has been used in America for internal combustion engines driving mechanical transport. There is no real necessity for this in view of America's oil supply which is made available by even more extensive pipe lines than those utilized for natural gas.

The use of calcium chloride as a dust arrester for the treatment of coke appeared to be quite satisfactory and did not detract from the appearance of the coke except to make it a little darker.

I did not visit the Rochester Gas Works so I am unable to give my impression of the working of the Sulzer plant at that Works. The heavy oil used in the manufacture of carburetted water gas is mostly the heavier fractions of petroleum, commonly called bunker oils. These oils are not subject to the same fluctuations in price as gas oil which varies with the price of petrol and in some parts of America they are actually cheaper than coke.

The chequerless type of carburetter referred to by Mr. Clegg which is usually provided with a combustion arch to assist mixing during the blow period, is extensively used when carburetting heavy oil as carbon deposits fall to the bottom and can easily be removed.

I regret that it is quite impossible to give relative prices of coal, oil, and coke which, in a vast country like the United States of America, are dependent upon geographical position in relation to the source of supply. Coal is very cheap in Pennsylvania where much is worked from open mines; oil is correspondingly cheap in the vicinity of the oil fields.

Dr. G. E. Foxwell in a written communication on the Thylox process of liquid purification, refers to its low operating costs. A figure of cost of purification by the Ammonia Thylox process given by Mr. Fred Denig of The Koppers Research Corporation at the American Gas Association Meeting was 0·42 cent, say 0·25 pence per 1,000 cu.ft. including all capital charges on a very large plant purifying 30 mn. cu.ft. per diem. The impression I formed was that the Thylox process had much to commend it for adoption in gas works practice, the cost of operation being equivalent to that of oxide purification.

Mr. F. J. West in the course of his remarks referred to the advantages of personal contact in the interchange of ideas with our friends overseas, and I trust that in 1936 we may have an opportunity of seeing our friends from Canada and the United States on this side of the water for a further interchange of ideas on the many problems upon which we are working in common.

2—Distribution and Utilization

By C. A. MASTERMAN, M.A., F.I.C.,

Chief Technical Officer, Gas Sales Department, The Gas Light and Coke Company.

Mr. C. A. MASTERMAN, replying, wrote: Dr. Walter has referred to the possibility of using low priced gas in America for steam raising. A very large contract was signed while the visit to Chicago was in progress for the supply of 15 mn. cu.ft. a day at 3 cents (1½d.) per therm to one of the big packing firms down in the stock yards, primarily for this purpose. With gas at that price, made possible by the availability of natural gas, large scale steam raising was obviously a practical proposition.

The testing of appliances by the A.G.A. was very thorough and systematic, and Dr. Walter has referred to it as an arrangement which might well be copied in this country. It has to be borne in mind, however, that the A.G.A. Laboratories though thorough and systematic in their methods of test appeared to stop short of the full co-operation which exists in Great Britain between some of the undertakings' laboratories and appliance makers. The A.G.A. Laboratories constitute a testing centre and not a development centre.

The apparent absence of industrial laboratories among the undertakings in America is compensated for by the laboratory resources of the makers of industrial appliances and the employment of a number of technically competent representatives by the undertakings. Industrial apparatus design in America did not appear to be in advance of the best designs in Great Britain, but supervision of installation work and the carrying out of tests on installations was more thorough. Although cookers of stamped steel, or having the appearance of stamped steel, construction were common in America it does not necessarily follow that this example should be slavishly followed in Great Britain. The advantages connected with stamped steel are not necessarily connected with performance or even with appearance but rather that with a large production it may be possible to produce at a slightly lower cost. A large production is a *sine quâ non* in view of the high cost of tools, and the impression was gained in America that in some cases this high cost was not economically covered so that the cost of cookers in many cases appeared high.

Mr. Chandler referred to installation by contractors, an important aspect of which was that the use of a contractor made a friend of the contractor and the Gas Industry profited by that friendship. Few of the generalizations made in the Paper, however, are universally true, and in some parts of Canada and America co-operation with the contractors is less close. Similarly regarding the payment of commission on sales, in Montreal the system had been given up although formerly it had been in use.

As to whether the use of the telephone in America was overdone, some people consider that it is overdone in Great Britain! However, the system described in the Paper and which is unfamiliar in Great Britain appeared to have some advantages, where the consumer ringing up the local office connected directly with a specialist operator who, if he wanted assistance, could bring in a second line on which was the inspector, or other expert official, the conversation continuing throughout without a break.

There appears in Great Britain, however, room for a wider development of the home service system. In the United States this involves the use of the gas undertakings' showrooms as a social centre where the consumers could meet their friends and at the same time get general assistance in connection with household problems. These problems might go far beyond the use of gas, and could include such relatively remote questions as etiquette in arranging a dance or bridge party. In Great Britain a demonstration of cooking sometimes represents all that is done in this direction.

3—Administration, Accounting, and Publicity

By THOMAS CARMICHAEL, M.Inst.C.E., M.I.Mech.E.,

Engineer and General Manager, Portsmouth Gas Company.

Mr. GEORGE W. ALLEN (Secretary-Treasurer, Canadian Gas Association, Toronto, Canada) wrote: Considering the little time the visitors were with us on this side of the water, and the speed with which the tour had to be carried on, it is exceedingly surprising in reading the Authors' impressions, to find how much they saw, and with what exactness they have been able to tell their story, so true to detail in every particular.

The Gas Industry of Canada and the United States of America is flourishing (notwithstanding an occasional depression to damper out spirits) and much of this can be accounted for in the fact that the greater number of us have faith in the gas business. I thoroughly believe that the "bogey" man is a necessity in every business. There is a danger with all of us of becoming so self-satisfied with our progress that before we are aware of it we have fallen asleep, and much loss of business results from our inactivity.

But real competition from electricity, oil, coal, and other fuels has tended to keep us alert, and we are thankful to say has forced us to do much studying of our product, until now, those of us who do know something about gas, and what it can do under given circumstances in domestic, commercial, and industrial applications, no longer fear, as we once did, the competition of the fuels mentioned. We cannot afford to sit idle. We must be on the move. There is much to be done before gas will be known as the universal fuel, but it is surprising how much each of us who have faith in our product can do towards bringing us a step nearer to this happy position.

The rise of electrical competition in the Old Country will be found in the long run to be one of the best things that could ever happen to the gas business. It will awaken every gas man to action and to a clearer and better understanding of his product, and the resultant activity will bring in a new era for the Gas Industry of Great Britain.

It is my sincere hope that your deliberations in London at the 71st Annual General Meeting of the Institution will encourage one more step towards that high ideal of service to mankind for which we are all, I trust, striving. The gas man who seeks the good of his customer by being a true servant of those with whom he does business need never fear loss of goodwill or public confidence.

Effective Merchandizing.

Mr. HUGH CUTHERELL (Manager, the Brooklyn Union Gas Company, Brooklyn, U.S.A.) wrote: Efficient and effective merchandizing of gas appliances can best be accomplished by gas companies aggressively engaging in and supervising sales of domestic gas appliances. In fact, on the basis of experience in Brooklyn and knowledge of conditions elsewhere I firmly believe that the only manner in which our modern gas appliances can be merchandized properly is for gas companies to engage in and supervise gas appliance sales in co-operation with master plumbers and other reputable dealers.

To present a general picture of the gas appliance merchandizing problem, as well as to form a background for explaining our activities in Brooklyn during the past score of years, I will consider the four general classifications into which gas appliance merchandizing falls. These four are:

(1) The gas company merchandizes alone and, accordingly, in competition with dealers.
(2) The gas company merchandizes in co-operation with dealers.
(3) The gas company establishes a separate merchandizing company.
(4) The gas company solely promotes gas appliance sales, the merchandizing or direct selling being done by dealers and agents.

Under the first plan the gas company obtains certain advantages. It can direct appliance merchandizing from the load-building standpoint; it avoids the dangers resulting from price-cutting by dealers; and it adheres to company policies in the merchandizing effort.

Balancing these are certain disadvantages. There is opposition from plumbers, other dealers, and in some respect the public. There is a tendency of the dealer to merchandize appliances using other types of fuel. There also is the installation of a greater number of poor quality, inefficient appliances on the company's lines as a result of dealers selling them in their effort to compete with the gas company on a price basis.

Where the utility sets up a separate merchandizing company it obtains all the advantages under the first plan together with some co-operation from the dealers. However, the co-operation between utility and dealers is not nearly as complete as under our plan in Brooklyn. There is also the loss of the mutual feeling between us; there no longer seems to exist the relationship of allies as exists under the dealer-co-operation system.

Under the third plan when the gas company withdraws from the direct merchandizing of appliances, it is relieved of the large investment in stock, the cost of storage and transportation, and the losses resulting from a surplus of appliances. There also results the elimination of unprogressive dealers who hinder rather than help gas appliance sales.

However, offsetting these advantages is the fact that the gas company loses all the advantages it had when it merchandized appliances alone. There is also a limitation of dealer-co-operation and no profit on appliances to offset promotional expenses.

I skipped the second plan of merchandizing in the above brief résumé because I wanted to discuss it in connection with our merchandizing activities in Brooklyn. Like other gas companies, the Brooklyn Union was selling gas appliances, such as they were, back a score of years ago. We continued our sales efforts up until after the United States entered the World War.

After our entrance into the war the Government was faced with the problem of conserving some of its natural mineral resources, particularly coal. In response to President Wilson's request to gas companies to economize on coal, James H. Jourdan, President of the Brooklyn Union, co-operated in letter and spirit. He ordered the discontinuance of appliance sales in order to restrict the consumption of gas to the appliances then in use in our territory.

Unscrupulous Merchants.

While we went out of the appliance business in order to co-operate sincerely and completely with the Government, various people in our territory entered the appliance sales business. Among them were many unscrupulous merchants who swooped down and sold cheap, unreliable appliances in our territory. Other merchants, however, endeavoured to sell appliances that were of a quality meeting our standards.

The unreliable merchants did not know quality or try to sell quality merchandize. They looked only for sales on a price basis. To them a range was a range. They sold unreliable appliances—ranges which were made of cheap material—and just slapped together. The result was a flood of complaints to the gas company because these dealers told dissatisfied customers that the gas company was making rotten gas.

With our return to appliance merchandizing in 1919 we were faced with several problems. We had a large number of cheap, undependable appliances on our lines—a condition we spent years trying to correct. Again we were face to face with the competition of dealers. No effort was made to stifle the competition of those dependable plumbers and other dealers who were selling approved appliances. However, we did try to fight the competition of those dealers who were selling poor appliances. This competition was severe because people were purchasing appliances on a price basis. This was especially true during the depression year when we suffered a decrease of almost 55 per cent. in the dollar sales price of our appliances. This may be seen from the accompanying table which shows our appliance sales, in dollars and cents, during the period from 1920 to 1933, inclusive.

But we were not deterred. We had returned to appliance merchandizing in order to reduce the objections of people to poor operation and to promote the use by our customers of quality appliances. Thus we were conducting an educational campaign among our customers on the use of efficient, reputable appliances while meeting the competition of the merchandizers of cheap, undependable appliances.

That we were meeting with success is evidenced by a study of the table of our net appliance sales during the years from the depression of 1921 to 1929 when we entered upon a dealer-co-operation programme.

Our decision to take this step was in line with our efforts during the preceding years. We decided that the aid given

Net Appliance Sales.

Year.	Domestic.	Lighting.	Industrial.	Total.	Refrigerators Included in Domestic Total.	Per Cent. Ref. to Total.
1	2	3	4	5	6	7
	$	$	$	$	$	Per Cent.
1920	662,021.13	98,203.37	98,399.09	910,365.00	..	..
1921	310,779.29	52,411.48	49,186.44	412,377.21	..	..
1922	710,148.18	40,776.72	52,357.62	803,282.52	..	..
1923	930,866.19	89,875.18	92,171.94	1,112,913.31	..	..
1924	961,710.36	44,601.17	106,518.80	1,112,830.33	..	..
1925	1,200,990.39	18,917.90	151,512.90	1,371,421.19	..	..
1926	1,379,503.99	9,245.77	142,892.60	1,531,642.36	..	..
1927	1,067,290.69	4,455.29	214,040.64	1,285,786.62	..	..
1928	1,206,806.00	2,527.23	153,971.10	1,363,304.33	267,966.87	20
1929	1,775,631.99	..	151,608.94	1,927,240.93	783,555.59	41
1930	2,065,966.48	..	110,096.64	2,176,063.12	1,073,313.74	49
1931	2,622,440.75	..	75,735.98	2,698,176.73	1,623,712.31	60
1932	2,019,008.80	..	57,064.18	2,076,072 98	1,192,684.98	57
1933	1,967,442.19	..	41,636.71	2,009,078.90	1,377,240.21	69

us in our educational appliance sales efforts by reputable dealers could be increased through the master plumbers of our territory co-operating with us in the sale of approved gas appliances. In turn we would have those co-operating master plumbers do the connect work on our appliances. Furthermore we would help develop them as real merchandizers of quality gas appliances.

Speciality Salesmen.

While dealer-co-operation in Brooklyn was developing our district sales force consisted of speciality salesmen. One group sold refrigerators only, another group water heaters, and a third group other types of domestic gas-burning appliances. A transition then took place, and through our educational efforts salesmen were taught to merchandize all types of appliances. Each salesman was then given a definite territory, and he was responsible for the sale of all domestic appliances within that area. At that time we were employing approximately sixty-five district salesmen, and our sales plan provided for the expansion of this group to include one hundred and sixty-five men.

Then dealer-co-operation developed sufficiently to indicate to us that it would be feasible to have the neighbourhood plumbers assume part of this merchandizing activity. As a result a comprehensive dealer-co-operative plan was developed which welded some three hundred plumbers into a huge merchandizing unit working in harmony with our own sales force. In developing this plan it was essential that the compensation plan under which our sales representatives operate take into consideration the necessity for co-operation between the company salesmen and dealer representatives.

Our merchandizing plan, therefore, provides that each salesman within his territory is responsible for the merchandizing effort of the plumber dealers in this area. It is to our salesmen's interests to help educate the plumber dealer and to help him in closing difficult sales. In order to accomplish this our salesmen are paid a commission on all sales made by the plumber dealer in their respective areas. Under this plan our salesmen profit by our dealer-co-operation plan. There now being only thirty-two district salesmen to cover an area of one hundred square miles, the dealer representatives provide the additional necessary coverage. There still remains much virgin territory open to the wideawake merchandizing dealer.

Our reason for merchandizing is not to obtain profit therefrom. It is primarily to see that only modern approved appliances are sold in order that our consumers will enjoy the most complete gas service. The quality of appliances sold by the utility is guaranteed by the American Gas Association Testing Laboratory. Consequently when the plumber-dealer co-operates with the utility in the sale of approved appliances, he too enjoys the assurance of a highly satisfied consumer which usually leads to repeat orders.

Each year since the start of dealer-co-operation there has been an increase in dealer business. This dealer business is composed of purchases of appliances by dealers for resale to customers and sales by our salesmen as a result of prospective leads developed by dealers. This business is tabulated at the foot of the preceding column.

Year.	Dealer Purchases.	Sales Through Dealer Leads.	Total.
1	2	3	4
	$	$	$
1929	77,554.74	11,989.95	89,544.69
1930	239,596.78	125,878.41	365,475.19
1931	387,177.07	243,145.72	630,322.79
1932	455,549.49	177,988.11	633,537.60
1933	580,698.09	117,636.15	698,334.24
	$1,740,576.17	$676,638.34	$2,417,214.51

These figures show how dealer-co-operation has been successful in Brooklyn. Taken in connection with the annual appliance sales they indicate the success attained in gas appliance merchandizing by the plan whereby gas companies aggressively engage in and supervise the sales of domestic gas appliances in wholehearted co-operation with the utility.

Now, as I said before, our reason for merchandizing is not to obtain profit therefrom. We try to develop and promote the use of approved gas-consuming appliances. It is, however, difficult to figure out the new gas consumption added to our lines as a result of our merchandizing practices and policies. While only an estimate can be made, one very clear indication of additional consumption can be provided through the refrigeration business.

At the present time, as a result of our sales efforts and those of the dealers, we have about 39,000 refrigerators on our lines. These have a total annual gas consumption of 700 mn. cu.ft. This is an entirely new load which does not replace any previously existing load. It has been developed practically entirely since the advent of the dealer-co-operation movement in our territory. It has resulted from the combined efforts of our dealers and our salesmen backed up and supported considerably during the past year by our employees through the Employee Sales Plan discussed in an article in *Gas Age-Record* in its November 25th issue.

No distributor or agent of the manufacturer could have built up the refrigerator sales in Brooklyn that our Company has. It required promotional and sales work on our part and co-operative sales effort on the dealers' part. As a result of these sales of refrigerators we have been enabled to maintain our gas load which has been seriously threatened by depression and competition. On the other hand there has passed into the pockets of our dealers in the past few years several hundred thousand dollars in commissions and connect work. I have had many a reputable master plumber tell me that the work made possible through our dealer plan has saved him from ruin and bankruptcy.

And it has not taken anything from us. Instead it has benefited us as well as the dealers and the public. The volume of business to the dealers is not only the profit from appliance sales but also the installations and connect work and a great amount of other auxiliary work that the plumbers have carried on within the home unknown to us.

The cost to the public has not increased because of dealer-co-operation. The active plumber has been able to earn through his merchandizing efforts a very fine revenue. We in turn have benefited from maintaining and holding through a severe business period a large appliance business which in turn aided us in upholding our gas send-out. We have also promoted and developed the use of modern, approved gas appliances which guarantee quality and satisfaction to customers.

No Change of Principle.

Our idea of dealer-co-operation has never changed in principle from the time it started. Through the intervening years we have learned certain things. We must be fair to all active dealers; we must have a restricted number of high-class salesmen to give the proper attention needed in building up the dealers' sales force. We have learned that discounts must be fair and equitable and of sufficient amount that any dealer embracing our plan will receive ample return for the effort that he expends.

The figures which I have given in this article and my own

experience in gas appliance merchandizing convince me that dealer-co-operation is not an expensive luxury to combat political agitation. Time enough we have to be on the alert for this political agitation and stop the disastrous results these Machiavellian machinations of unscrupulous politcians bring upon the three groups involved in this business—the gas companies, the small dealers, and last, but most important, the public.

These political activities, which are designed from a dishonest motive, can effectively be counteracted by strong dealer-co-operation movements. Such co-operation as this strengthens public and dealer goodwill through providing a fair deal for the public and the dealer, while protecting the gas company's interests.

Dealer-co-operation has proved to be a sound economic move to increase retail sales outlets and retail sales force. As a result of our experience I believe the merchandizing of approved gas appliances should be aggressively supervised by the gas company and carried on by it in wholehearted co-operation with master plumbers and other reputable dealers.

Major ALEXANDER FORWARD (Managing Director, American Gas Association, New York, U.S.A.) wrote: Mr. Carmichael has accomplished in a manner for which I have great admiration what, under the brief and hurried circumstances of his visit to America, must have been a difficult task. I have read his Paper with much interest and with full appreciation of the breadth of his vision as well as the amount of material he was able to collect and digest in the short time available.

From the wide field covered I address the following remarks to that section dealing with regulatory control of gas companies in the United States by public service commission.

All of the States of the American Union, save one, have commissions charged with the duty of regulating the rates and service of some or all of the public utilities. Members of these commissions are in some States elected by popular vote, in others appointed by the Governor, and in at least one instance are elected by the State legislature. Most of these commissions have three members, some have five, two States have a single commissioner.

Multiplication of rate cases, particularly since the Great War, has resulted in accumulation of volumes of judicial decisions, and in each State there are law firms specializing in rate cases both for and against the utility companies. With growth of the practice of determining fair value of utility property upon which a fair but not excessive return to investors may be earned through balanced non-discriminatory rate structures, the machinery of valuation and appraisal by engineering concerns, usually specialists, has grown enormously.

Rather unfortunately for the public interest, changes in the personnel of these State commissions have always been rapid. This movement has been greatly accelerated during the political upheavals of the past two years. From Jan. 1, 1933, to May 1, 1934, fifty-six of about 175 commissioners have left office; still, four of these had been in service more than twenty years, and thirteen others more than ten years. Political party considerations and reversals of parties and factions in power are partly responsible. Many commissioners after a period spent in accumulating valuable experience have gone elsewhere. While it is possible that these changes are more rapid where commissioners are elected by the people than when appointed by the Governor, and while theoretically selection by appointment is more likely to command the services of better equipped men who do not care to contest for an elective office, the points are debatable. Usually the commissions are not sufficiently equipped with technical, accounting, and legal assistance, due to the difficulty of securing adequate pubic funds appropriations for this purpose.

These commissions have a national association composed of all members of all State commissions and of the inter-State commerce commission which regulates the inter-State business of railways. The national association has no legislative powers, but through interchange of views and experiences in annual meetings there is a strong tendency toward general recognition throughout the country of the principal problems of regulation. In this way a certain degree of uniformity is attained. Appeals from State commissions are provided to the higher State courts, with the recourse of final appeal to the United States Supreme Court, where a substantial federal question can be shown. From a personal experience of six years as a member of a State commission (Virginia) and from close association with the commissioners of all the States for many years, it may fairly be said that the commissions are made up of men of good ability, sincere purpose, and fair mindedness. Most of them are morally capable of withstanding public clamour for low rates often manufactured for political purposes, and are fully conscious of the interest of the public in the solvency of public utility companies and of the further necessity of making their shares sufficiently profitable so as to contract additional capital when required for construction and extensions.

The Position in Toronto.

Mr. ARTHUR HEWITT (Immediate Past-President, American Gas Association, Toronto, Canada) wrote: I should like to premise my remarks by complimenting Mr. Carmichael upon the general accuracy of the account which he has given of the conditions under which the Gas Industry is conducted in Canada and the United States. It is truly remarkable that he should have been able to acquire so much information on the many matters dealt with in so short a period of time. It is another illustration of British thoroughness.

In giving consideration to the observations which I shall make, members of the Institution will please take account of certain facts regarding the Toronto situation.

The Consumers' Gas Company of Toronto is a privately owned and operated Company, just completing its eighty-sixth year of service. It is heavily taxed by the Dominion and Provincial Governments and by the local Municipal authorities. Its taxes equal about fifteen cents (7·5 pence) per thousand cubic feet of gas sold.

The Toronto Hydro Electric System is a publicly owned organization which distributes electrical current within the City of Toronto, such current being delivered to them at their lcoal sub-stations by the publicly owned Ontario Hydro Electric Power Commission, who own and operate the generating stations and transmit power to many local municipalities throughout the Province. All of these undertakings are exempt from taxation, and the bonds which they issue from time to time to pay for their capital investment are guaranteed by the Provincial Government in the one case and by the various Municipal authorities in the case of the local organizations. Under such circumstances, it will rightly be inferred that the competition is decidedly unfair to the gas company.

All of the street lighting is, of course, electric, and on very profitable rates for the Hydro Electrical System; the City pays the bill. The power used by the Toronto Transportation Commission for its street railway system is supplied by the Toronto Hydro Electric System, at profitable rates for the Hydro. The Toronto water works pumping plant is operated by power supplied by the Toronto Hydro Electric System, at favourable rates for the Hydro; the City pays the bill.

Commercial lighting rates are comparatively high, with no competition. Industrial power rates are said to be higher than in the Province of Quebec, where the electric undertakings are privately owned.

When it comes to domestic rates designed for the capture of the domestic cooking and water-heating loads, the rates are among the lowest on the continent—less than 1 cent per unit.

This being the competitive situation which my Company has to meet, we must of necessity make our gas service superior to any other service at a cost to the consumer which will make the service attractive to him.

So far we have succeeded, and we are optimistic enough to believe that by the proper conduct of our own business we can continue this success.

When I had the privilege of attending the meeting of the British Institution of Gas Engineers in London in the year 1926, I was much impressed by the paper presented at the meeting by Mr. W. B. McLusky. One section of that paper dealt with "Charges for Gas and Service" and "Equitable Distribution of Overhead Charges." Opportunity was afforded to me to make some observations, and at the conclusion of my remarks the President invited me to submit a memorandum in writing which might be included as part of the discussion. This memorandum was published in your Transactions for 1925-26, and will be found on pages 579-585.

Effectiveness of Two-Part Tariff.

Further experience has fully demonstrated the effectiveness of the two-part rate in meeting competition from other fuels, and, particularly, competition with electricity for domestic cooking.

When one considers that in Toronto there is practically no gas used for lighting purposes, and that the secondary rate for electricity for domestic cooking ranges is as low as ½d. per unit—after the service charge and the primary rate have been applied—it will be realized that only by the adoption of the service charge principle and very low commodity rates can gas successfully compete with electricity for domestic cooking. The same facts apply also to domestic water heating.

Customers living on wages and salaries prefer monthly accounts. When gas bills are rendered quarterly, they cause an uneven distribution of their living expenses, which they usually fail to anticipate. Under present economic conditions, monthly accounts fit into curtailed

family budgets much more easily than do quarterly accounts. In the case of one American utility where bi-monthly billing was adopted some years ago as a measure of relief from the then shortage of labour, an appreciable increase in the amount of uncollectible bills resulted. By the time a delinquent customer's services had to be discontinued for non-payment, credit had been extended beyond 90 days, whereas under the plan of monthly accounts, this period was limited to 60 days. It was also found necessary to double the amount of the security deposit required from a customer, while the cost of the collection function remained the same as under the system of monthly billing. With quarterly accounts, the customers' calls at the office and showrooms are less frequent, and opportunities of interesting them in the display of appliances are greatly reduced. Slot meters present a rather serious problem in the adoption of a two-part rate.

Mr. Carmichael has caught some of the enthusiasm of the Canadian and American gas men, since in seven out of his eight conclusions he is definitely commendatory of the practices which he observed here, and recommends them to the consideration of the British companies.

Only in paragraph 4 is he critical, and in reference to his findings on machines in offices, I may say that the introduction of machines for office work is usually accompanied by savings in the cost of operation. In addition, uniformity of output is a very desirable feature of machine production.

I should perhaps refer to one other important matter in the Toronto situation, which is about the same in all of the larger Canadian and American cities—that is, the migration of consumers. On the average, 25 per cent. of our consumers change their place of habitation every year.

I am convinced that when you come to lay plans to combat—what is presently with you only a threat—electric competition, you will seriously consider three things: (1) Your rate structure, (2) Machine accounting, (3) Monthly billing—short settlements make long friends.

Before a detailed comparison can be made of the office practices and costs of operation between the two companies in Portsmouth and Toronto (see Mr. Carmichael's Paper* to the A.G.A. Convention, 1933), a description of the general character of the territory served by each Company is necessary. In addition to a comparison of the scales of wages paid, such factors as population trend, moving habits of the people, industrial development of territory, character of competition, the extent of the area of supply, and the number of customers per mile of main, would have to be considered in the light of their individual and collective effect upon the cost of performing the various office operations.

From the description given in Mr. Carmichael's Paper it is apparent that Portsmouth has very little industrial development, and that for the most part the 250,000 inhabitants secure their living from employment in naval or military activities. From a collection standpoint one can hardly imagine a more ideal situation, and the loss from bad debts amounting to only 0·13 per cent. of the sales would indicate that Mr. Carmichael has no collection problem at all. Incidentally, one can hardly picture the chaos that would ensue if, in Toronto, we rendered our bills quarterly and then allowed four or five weeks to elapse before sending even a polite notice to those consumers whose accounts were not paid. The fact that Mr. Carmichael does not find it necessary to employ collectors and relies entirely upon the efficacy of two collection notices, and with such satisfactory results, makes a comparison of the collection costs between Portsmouth and Toronto entirely futile and valueless.

We can, of course, make comparisons of the standards of performance on similar operations in each Company, keeping in mind the differences in conditions under which the Companies operate.

—	Portsmouth.	Toronto.
1	2	3
Area of supply	103 sq. miles	312 sq. miles
Miles of mains	327 miles	1,000 miles
Consumers	72,000	170,000
Ordinary	30,000	170,000
Prepayment	42,000	..
Consumers per mile of main	220	170
Number of readings per year	4	12
Average number of readings per man per day	110	268
Readings per year	120,000	2,040,000
Labour required—man-days per year	1,092	7,620
Cost per consumer per year	2.32 cents.	18.6 cents.
Cost per reading	0.58 ,,	1.55 ,,
Average daily wages paid	$0.64 or 2s. 8d.	$4.135 or 17s.

* "Meter Reading and Collecting of Accounts," by T. Carmichael, A.G.A. Proceedings 1933, p. 425.

The differences which stand out in the above comparison of results are:

(1) The production per man per day. In the case of Portsmouth if the locations of the ordinary meters are scattered throughout the area of supply the distances between those meters would be greater than in Toronto.

(2) The large difference in the scale of wages paid.

The method used of placing the gas bills in the hands of the consumers in Portsmouth is not clear from Mr. Carmichael's paper. In Toronto the bills are delivered by boys, who, in addition to delivering the bills to the consumer's premises, also place a piece of advertising matter with each bill before placing it in the consumer's letter box.

Total gas bills delivered per year	2,040,000
Average per man per day	900
Labour required—man days per year	2,266
Scale of wages per week	$13.50 or £2 15s.
Cost per bill (actual delivery)	0.25 cent
Cost per bill (including preparation of routes, supervision, &c.)	0.30 ,,

Gas bills are printed on an addressograph-printing machine. From a roll of paper which is fed into this machine, at one end, the bills are thrown out at the other, printed on both sides, the paper cut, the coupon perforated for easy detachment, and the bills numbered consecutively.

The individual consumer's name and address are printed on each bill during the process. The completed forms, addressed ready for billing, are turned out at the rate of 2,000 per hour.

The completing of the bills is performed on five Burroughs Public Utility Billing Machines. These specially constructed machines make out the account, place the charges on the ledger card, and prepare the sales register all in one operation.

Average production per hour	260 bills
,, ,, ,, week	8,500 ,,
Scale of wages per week	$13.90 or £4 18s.
Labour cost per account handled	2.81 cents

The machine expense would have to be added to the above figure to obtain the total cost.

Mr. Hugh McNair (Immediate Past-President, Canadian Gas Association, Winnipeg, Canada) wrote: Will you please accept my sincere thanks for having given me the opportunity of taking part in the discussion on Mr. Carmichael's paper. I want, Sir, to congratulate the Author on his very excellent Paper and on the remarkable amount of information which he has obtained in such a limited time as was at his disposal. I propose to deal very briefly with some of what I would call the high lights of the Paper. Let me first deal briefly with the growth of the Industry, page 6.

There can be no doubt that in spite of the low electric rates offered especially in Canada that there is still a wide field for gas, especially in industries. It is only some nine years ago that the City of Winnipeg Hydro Electric System commenced to wire apartment blocks free, supply free electric stoves, and sell electricity for cooking at $\frac{2}{10}$ of 1 cent per unit. The Gas Industry lost in one year approximately 60 mn. cu.ft. annually, but within two years we had not only recovered our loss but had added 30 mn. cu.ft. to our sales. I do not say this in order to boast in any way, but to show you that the business was there and had only to be gone after, and that it only required a severe jolt, such as we got, to waken us up. It can be truly said that our city is an electric city and that our future is in industrial, commercial, house heating, and water heating. For even though we have to compete with very low electric rates we can hold our own in the above-mentioned fields by offering an attractive rate.

This is one subject on which I would like to spend a great deal of time but I will not inflict myself on you at any great length. I was, from the inception of the Public Utilities Commission of Manitoba until ten years ago, Gas Engineer to the Commission, and I know that the Company did then, and does now, appreciate the work of the Commission which has jurisdiction over all rates, has power to direct the adjustments of all complaints, even high gas bills, and the Company frequently appealed to us for a decision in many cases. The Commission was always ready and willing to give advice when asked to do so, and the relations between the Company and the Commission have always been harmonious.

Joint Ownership.

I agree with what Mr. Carmichael says about joint ownership, but I am not so enthusiastic when our own Company own the Gas Utility, a Hydro-electric Utility, a Street Railway or Tramway System, and then the City of Winnipeg also owns a Hydro-electric System. This situation creates intense competition between the two Electric

Utilities which the Gas Utility has to meet. In our case in particular the operating cost is greater than electricity for cooking.

Prepayment meters are in most cities frowned upon, but in some of the cities where we have a large floating population we are compelled to use them. For instance, in a light housekeeping house perhaps there will be ten rooms rented to ten different parties. These people may stay in this location for from one to two weeks, and the majority of them certainly do not stay more than about two months, so that the only means we have of collecting is by prepayment meters. Out of a total of nineteen thousand meters we will have about nine thousand prepayments. We also consider that collections monthly from regular meter consumers are more advantageous, but I will not take up more of your time on this subject.

We find that cookers have to be made as attractive as possible in order to compete with the electric cookers, and in some cases the colours of the cookers have to harmonize with the kitchen colours. We have in Winnipeg not only a self-lighter on the top burners but also one in the oven, and find this is a strong selling point as no matches are required, and consequently none are left lying about for the children to get at.

A great many of the companies over here keep what we call a Rehabilitation Squad who visit the various customers regularly, clean out the burners, adjust the air supply, and replace any minor parts which may get broken. This service is free.

We give a special rate for house heating and water heating; both appliances are on the same meter. Our rate is 60 cents net for the first 10,000 per month and 45 cents for all over 10,000. We find that this rate is adding considerably to our load, especially in the winter. It should be remembered in this connection that we have not a single customer who uses gas for lighting, consequently we have not the peak load in the winter here which you will have in Britain.

In Winnipeg we do no retailing of coke. The dealer who supplies us with coal agrees to purchase all our coke. The dealer is required to take delivery of the coke at coke crushing and screening plant hoppers and is required to pile and reclaim the coke at his own expense. Last year we received a price of $10.00 per ton (2,000 lbs). at the hopper.

Mr. Clifford E. Paige (Past President, American Gas Association, New York, U.S.A.) and Mr. Hugh Cuthrell (Brooklyn, U.S.A.) jointly wrote: In the compilation of factual material, Mr. Carmichael has shown an absorptive power that is most impressive. Even with the facility of notes and illustrations, it is amazing that one could, in so short a time, gather so accurate and so comprehensive a knowledge of our facilities and methods.

His opinion as to the usefulness and value of what he saw—is his opinion. To the extent he agrees with the procedure which he found, there is nothing left to argue. With characteristic British courtesy, Mr. Carmichael deals lightly with our shortcomings and praises, perhaps beyond warrant, those activities in which the utilities on the American continent have attained some measure of success. Doubtless, there are many things which to any visitor might seem poorly developed or over developed. Mr. Carmichael's innate tact might cause him to withhold comment lest he be considered too critical.

A Yardstick for Evaluation.

We welcome criticism. It offers a new yardstick for our evaluation and it gives other eyes than our own, with which to view our result.

Some of our equipment and our procedure seem to us, at times, elaborate and expensive. But its development has been due largely to local exigency. We like to make progress; we dream and then try to execute. Much of what we have done has been due to the compulsion of competition and regulation, rather than to the Utopian stuff of which dreams are made. The judgment, in each detail of the evolution, may have been good or bad. At least, conclusions were not hasty, and in practically all ventures we waded before we swam.

The concise, yet thorough manner in which Mr. Carmichael covers the subject leaves little to be said by way of comment. There are, however, two thoughts expressed in the Paper which, in our opinion, should be stressed. One is the proposal to combine the existing British societies of the industry along the lines of the American Gas Association; the other is the adoption of sound rates as a means of expanding the business.

The American Gas Association was organized in 1916 through the merger of the National Commercial Gas Association and the American Gas Institute, a society of technical men. In 1927, the Natural Gas Association was merged with the American Gas Association, so that to-day, practically every gas company in the United States and Canada has membership in the Association.

The activities fostered by the Association furnish opportunities for the solution of problems common to the industry and bring results beyond those which could possibly be attained by the several companies acting independently. The Association Laboratory at Cleveland and the Statistical Division at Association Headquarters in New York, by themselves, are standing evidence of the wisdom and foresight of the utilities in organizing the American Gas Association. We are sure that our cousins in the gas industry overseas would profit by an organization of this kind.

From that part of the paper which deals with rate structures, we infer that there would be difficulty in Great Britain in promulgating rates of the character used in America. We recognize certain fundamental differences in the manner in which rates are formulated. If we understand correctly, your rates are based on the necessity of producing a given yield on the shares outstanding, while in America, rates generally are based on the proposition that the owners are entitled to a reasonable return on the fair value of the property devoted to the public service. In the American theory it is the value of the property on which the owners are entitled to a return and not the amount of money invested in that enterprise.

Perhaps, through the years, we have developed in this country a different financial structure, by reason of this principle of return. We believe our method makes for justice to both the owner of the property and the user of the service. Under this arrangement, the user of gas will never be called upon to pay a return on an improvident investment, and the number, amount, and identity of the holders of the shares are immaterial in the fixing of rates.

Customer Demands Service.

The customer pays for service. Our times demand speed, precision, and satisfaction for him. Money saved on service would presumably go to reduce rates. What does the customer want, satisfaction with his service or a lower rate? Naturally, he desires a low rate, but he demands service.

Top-notch service costs money. The saving possible in this direction would make a very small difference in the rate paid, even if all voluntary service were eliminated. On the other hand, if this were done, we would soon have to find a new set of customers.

Moreover, we have this conception of the competitive aspect of our business; the better our equipment and the more satisfaction we can deliver, the greater is our investment in the future of our business.

In making excursions into new activities we have one protective consideration. If experience finds us wrong, we endeavour to correct. Hence, observation is always of a changing process rather than of an established or fixed practice.

One measure of value must be our adaptability. We must adjust constantly to new conditions.

We do not construe Mr. Carmichael's comments as anything but enlightening. Our discussion, therefore, is more by way of explanation than defence.

Mr. H. Stanley Taylor (Bath) wrote: I agree with Mr. Carmichael in his appreciation of the structure of the American Gas Association. Is it not worth very careful study? Have we not in the American plan the basis for far greater co-ordination in our organizations? Should we not seek closer alliance with allied industries? It appears to me that one powerful Association giving guidance to individual undertakings can be only for good.

In several cities we found the one undertaking supplying Gas and Electricity, the policy of the undertaking in every case was (where the choice was left to the undertaking) for cooking or heating purposes, recommend gas, due to gas being very much cheaper than electricity. I was surprised to find the price of gas so high in Canada and America, particularly so in what might be termed the natural gas area in Canada.

The mechanical accounting was very intriguing, and it would be interesting to get the comparative cost of mechanical accountancy as against human accountancy. It has to be remembered that mechanization is in its infancy, and where it was in vogue we found it was frequently being improved. Undoubtedly it is a very costly method to install, and while mechanization might be the proper development in America where monthly billing is the rule coupled with a higher wage payment, it would not be in this country where the quarterly rendering is the usual practice.

I offer criticism of the sales display in the Gas Showrooms which we visited. I suggest that apparatus will secure a greater and more ready sale if it is displayed in harmonious and tasteful settings. It was surprising to find so little attention was given to the sale of gas fires, no doubt for good reasons, very few of them were displayed in the show-

rooms, and where they were in evidence they were not displayed in harmonious and tasteful settings. In showrooms one frequently finds two or more identical models exhibited. The showroom should be something more than a display of ironmongery; it should be capable of giving ideas to the buying public, of itself thereby creating an interest in and a longing for possession. Too many exhibits are likely to confuse the mind of the purchaser. The Canadian and American idea of colour schemes for kitchens was very attractive, not costly and a good business getter.

Cooker Finish.

I am pleased that Mr. Carmichael calls attention to the attractive finish of the Canadian and American cookers. In my opinion our makers have something to learn from the Canadian and American manufacturers both in price, design, and finish. The finish of their cookers is better than ours. Some technical men attending the tour do not agree with this opinion. Some of their boiling points I preferred to ours. It is an advantage to the gas industry that electrical cookers are so expensive, but the point is how long will the present situation last? Have the manufacturers of electrical cookers said their last work and produced the ideal model? In my city a domestic consumer of electricity can purchase a supply at the all-in cost of less than 7d. per unit. This is an extraordinary statement, but true. I have myself seen cash receipts for payment over a period of eighteen months. I suggest that our manufacturers could well consider a reduction in size of their cookers (external size not internal size or space available for use), a reduction in weight, a reduction in price. I saw at the Chicago Exhibition a gas cooker priced at over £50—personally I would not have it at any price. As a mechanical achievement one cannot compare a £60 gas cooker with £110 motor car. I should have thought a standarized model could be produced to sell at very much less cost than they are at the present time, and enamel should be used inside and out.

I understand that on the research work for the British gas industry, conducted by The Institution of Gas Engineers, £6,000 or £7,000 a year is being spent. The American industry is spending a much greater sum than we are. The cost of running the Cleveland Laboratories is £30,000 to £32,000 a year. The amount we spend appears small as compared with the benefits that might be received, but in my opinion the increased amount should not be obtained at the expense of the activities of the British Commercial Gas Association. The idea of establishing a standard of efficiency is good; the higher the standard the better. Such stamping of gas appliances means greater confidence to the buying public. I do not agree with Mr. Carmichael's conclusion that the American Association's advertising and propaganda methods are better than ours. I consider that the activities of the British Commercial Gas Association are more effective than the American, especially so when they are backed up and taken full advantage of by the undertakings in whose interests they are being promoted.

Mr. Carmichael Replies.

Mr. THOMAS CARMICHAEL, replying, wrote: Mr. Madden referred to the question of Salesmanship and the reluctance in this country to employ a sufficient number of highly paid demonstrators and technically trained salesmen. The remedy, of course, is in the hands of the present executives of Gas Undertakings, who must offer more encouragement by way of opportunity and pay to the salesmen and to the Publicity and Service Assistants.

In Canada and the United States the competition is keen, and the Gas Undertakings are constantly at work developing new methods of service and improving old ones, with the result that service rendered has reached a very high mark, and is on a most efficient basis. Advertising is skilfully done and service propaganda, management, and such like costs must be higher than in this country, but this is offset by better results and by better service to the consumers.

It should be stated, in reply to Mr. Whitehead, that, generally speaking, the average price of gas over the whole of the Country is higher, but where natural gas is sold to very large consumers a cheaper rate may be given.

On the subject of dividends, Mr. Clifford Paige refers, in his contribution, to the position in the United States in this respect.

The relative positions of Gas and Electricity can best be judged at Toronto, where the Gas Undertaking (heavily taxed) has no connection with the electrical interests (exempt from taxation). In addition to this, the Electricity supply is probably one of the cheapest in the world, and, while Gas is not particularly cheap, it is more than holding its own.

In support of the suggestion of giving consideration as to whether or not advantages might result from the unification of the National Bodies in this Country, there were, as expected, several speakers for and against. It is admitted that much of what is being done in the States is due to the compulsion of competition and regulation. The American Gas Association is always five years ahead with its schemes of development, and any Paper, or line of investigation, is part of the co-ordinated programme. Technical circulars are sent out monthly on all subjects, and the information is in the hands of the Gas Undertakings almost before it is wanted.

Our National Bodies here might provide similar data, and if this were done in a manner most appropriate for the benefit of the members there would be less adverse criticism of their work and a service of the greatest possible assistance would be rendered. On the all-important side of our business—Sales and Gas Utilization—the Chief of each Undertaking is left to work out his own problems in his own way and to act independently, because of the lack of information and of a lead on many important problems. The Joint Co-ordinating Committee is doing excellent work, but " complete co-operation has still to be obtained." It is this co-operation and unification of forces that many are anxious should be brought about as speedily as possible with, in its trend, greater power and influence for the benefit of the Industry as a whole. As Colonel Carr says, " The impression of vitality and co-ordination within the Gas Industry, largely in consequence of the merging of interests in the American Gas Association, inspired the hope for similar co-ordination and co-operation at home." One thing is perfectly certain, and that is that a better getting together of the National Gas Organizations is desirable, and, as Mr. Taylor stated, " closer alliance with allied industries is required and more guidance to individual undertakings can be only for good."

The commercialization of refrigeration has centered largely around the Commercial Section of the American Gas Association. The technical development of air conditioning homes with gas in the summer originated with and was carried through by the Committee on Industrial Gas Research. These two instances are quoted as examples of how the American Gas Industry is represented in a most practical way by its National Association.

Gas charges were referred to, and appended hereto is the new scale of prices introduced at Portsmouth (Sliding Scale Company), in which there is an element of the two-part tariff system, which is proving an advantage over the fixed price with graduated discount. The lowest price is 4½d. per therm.

The two-part tariff is unattractive to most domestic consumers, and where a fixed charge for electricity is already in operation, it is unlikely that the householder will consider the payment of another for gas.

The comments of Mr. McLusky and Mr. Canning were helpful and useful, but were not in the form of criticism or question, and therefore need no answer.

It was particularly pleasing to the Author that, in response to the advance copy of the Paper which was forwarded to several friends important in the Gas Industry on the other

PORTSMOUTH GAS COMPANY.

Ordinary Credit Consumers Within the City of Portsmouth.

SCALE OF PRICES.

| Based on Consumptions over a Period of Three Months. | | |

side of the Atlantic, each has been good enough to send a valuable and interesting contribution to the discussion. Although there is little calling for specific reply in these contributions, it is most gratifying to know that, from a general standpoint, the Paper has been received so well in Canada and in the United States. With regard to the surprise expressed that such a large amount of information and material could have been gathered in so short a time as three weeks, it is emphasized that this was only possible because of the excellent facilities granted everywhere for obtaining detailed information, as well as the personal help so willingly and courteously rendered to the Delegation in every city visited.

For the contributions from these Transatlantic colleagues—which in themselves almost constitute an additional Paper—and for the comments from his co-traveller to America, Mr. H. Stanley Taylor, the Chairman of the Bath Gas Company, the Author wishes to convey his very best thanks. In conclusion, he feels that, if only for the value of the points raised by the discussion, the time spent in the preparation and presentation of the Paper has been well worth while.

Correlation of Costs and Gas Charges with Particular Reference to Working Results at Macclesfield

By H. CURTIS,

Engineer and Manager, Macclesfield Corporation Gas Department.

Mr. J. H. CLEGG (Southport) wrote: We are greatly indebted to Mr. Curtis and his Council for the courage they have shown in departing from the orthodox methods of charging for gas, and entering into a novel and enterprising procedure. As administrators of Gas Undertakings we have awaited the results of the new departure with some interest, and are now gratified that they have been placed before us in such a manner that we can form our own conclusions, and benefit from Macclesfield's experience.

To summarize, my own conviction has, I think, been confirmed, that facilities for obtaining gas cheaply must be given to those consumers who have earned the privilege, even if it does, in the first instance, mean some not unreasonable loss of profit, to increase or even secure the load, and consequent future prosperity of the Industry.

As block, step systems, and multi-part charges have been under consideration in the discussion, I would like to submit a brief summary of our experience in Burnley over a period of years for comparison. From 1919 we had systems of block charges which, in 1924, were considered to have outlived their usefulness. A step rate charge was therefore adopted for *all* domestic consumers, including gas used for all purposes at hotels, restaurants, bakehouses, and retail shops as follows:

Up to	50 therms per quarter	7d. per therm
Above	50 therms and under 250 therms . .	6d. ,,
,,	250 therms and up to 2,000 therms . .	5½d. ,,
,,	2,000 therms	5d. ,,

All less 5 per cent. discount for prompt payment.

This tariff applies also to prepayment consumers, and is still in existence. The following figures will indicate the effect, but the comparative increase in the number of prepayment consumers is indicative of the financial state of the town:

Prepayment Consumers.		Ordinary Meter Consumers.	
1		2	
1924	16,377	1924	13,429
1934	21,278	1934	10,893
Increase. . . .	4,901	Decrease . . .	2,536

The consumptions in therms (excluding industrial consumers) are:

—	1924.	1934.
1	2	3
Ordinary meter	1,777,507	1,455,370
Prepayment meter . . .	1,524,123	2,305,275
	3,301,630	3,760,645

Increase, 14 per cent.

The rebates returned to prepayment consumers are the best indication of the effect of the tariff over the ten years. It is indicated that the increased load is in the proportion of 30 per cent. in summer and 70 per cent. in winter of the whole.

Prepayment Rebates on the 1924 *Scale for the Past Ten Years*

—	Amount.	Two Summer Quarters.	Two Winter Quarters.
1	2	3	4
	£	£ Per Cent.	£ Per Cent.
1925	539	176 or 33	363 or 67
1926	1,021	373 ,, 36	648 ,, 64
1927	1,665	640 ,, 38	1,025 ,, 62
1928	1,285	393 ,, 31	892 ,, 69
1929	1,562	459 ,, 29	1,103 ,, 71
1930	1,710	452 ,, 20	1,258 ,, 74
1931	1,662	495 ,, 30	1,167 ,, 70
1932	1,506	456 ,, 30	1,050 ,, 70
1933	1,760	447 ,, 25	1,313 ,, 75
1934	1,457	375 ,, 26	1,082 ,, 74
Average for 9 full years	1,514	454 ,, 30	1,060 ,, 70

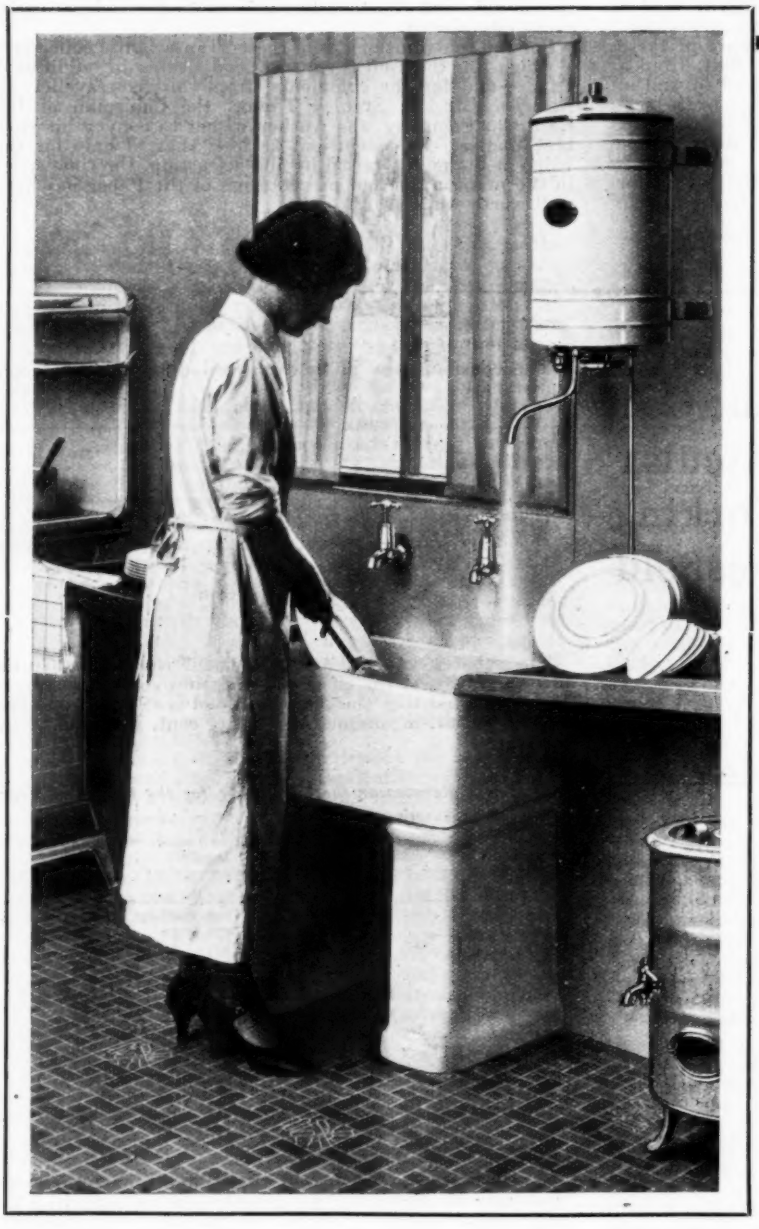
In 1930 it was considered that a multi-part tariff was necessary to deal with the development of industrial and commercial business. Up to date the number of consumers on this tariff is 42, 31 of which are new consumers converted from solid fuel. In 1930-1931 this load was 21 million cu.ft. per annum, whereas in 1933-1934 it has increased to 105 million cu.ft., and is still growing. The consumption per consumer has grown from 5,034 to 12,500 therms per annum over the same period.

In 1932 it was felt that a two-part optional tariff for domestic consumers could be introduced to meet the competitive "½d. per unit." The fixed charges are based on the number of rooms in the premises—6s. 6d. per room per annum, with a commodity charge of 4d. per therm. This scheme has not been successful; only 51 consumers are participating therein, possibly because it is competitive with our step-rate system. The latter system we are loath to discontinue, because it appears to be as yet the most satisfactory way of dealing with prepayment consumers.

Mr. H. CURTIS, replying, wrote: Mr. Blundell suggests that the system is perhaps a little too simple for the better class consumer, but I fail to see how any scheme can be too simple; in fact, I consider the simplicity of the system is one of the major advantages.

His objection that the maximum and minimum prices charged are insufficiently divergent is a point that became a necessity prior to the operation of seasonal charging and I admit that it would have been more advantageous to have kept the maximum price at, say, 8½d. per them. The difficulties of fixing any standing charge and the possibilities of these changing because of some outside influence, such as assessment, are apparent.

His reference to some consumers smarting under a



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sense of injustice does not apply in our case as they are accommodated for by the sliding scale; this, I think, is clearly shown in the examples given in the tables.

His reference to the small amount of capital outstanding is a position I fully appreciate and every effort has been made to retain this position.

The method adopted in the change-over from the winter to summer period in order to give each consumer his fair share of the larger discount did cause us a little concern at the commencement, but the arrangement now adopted is that for the slot consumers we arrange for six regular collections per year, three in each period and one cycle every two months. As the periods commence on the 1st April and 1st October we divide the two monthly cycles and only commence giving the 50 per cent. discount on the 1st May. This means that some consumers gain a month at the beginning of the period and lose a month at the end, whilst others operate *vice versa*. It is imperative, however, to commence each cycle of collections on a predetermined date. The ordinary collection causes no difficulty.

Mr. Ridley indicated that he appreciated a scheme whereby a more psychological appeal might be made to induce the consumer to use more gas. I submit that the results obtained, particularly in the case of P.P. consumers, have shown a successful result and that the cause in this instance is largely psychological.

His reference to the levelling up of the summer and winter loads not being accomplished is, in my opinion, due to the fact that whilst the summer load has definitely been increased, this increase has been maintained in the winter. In the figure of 340,000 therms increase in his summer period, what percentage is this and how does it compare with the 27·80 per cent. increase at Macclesfield? Mr. Ridley presented some very interesting figures with regard to his summer and winter increases, but it is difficult, without transporting these figures into percentages, to realize their bearing on the Macclesfield position. I would not suggest that the increases obtained in Macclesfield would not have been attained with any other scheme, but it is a fact that the figures submitted are the results obtained with " Seasonal Charging " operative.

There is no necessity to supply a ready reckoner; it was only given for the convenience of our customers.

Mr. Ridley points out that a very attractive block rate system could have been evolved for the industrial load, but I would point out that our industrial load only amounts to about 8 per cent. of our total, and we have, therefore, concentrated on the domestic load and for which load he admits himself that a two-part tariff is not attractive.

In reply to Mr. Fottrell, his main objection to the scheme appears to be that the maximum price charged is too low; to some extent I agree, but not entirely. One wonders if the increases shown per prepayment meter would have been so large if the initial charge had been higher. A high initial charge may have the effect of consumers never becoming able to increase their consumption. Theoretically, the argument appears sound, but in practice I think it fails.

This view, I think, is substantiated by Mr. McLusky, whose remarks seem to suggest that he favours a disguised service or standing charge rather than a definite figure and a commodity charge. The number of statistics given by Mr. McLusky leaves me very little to say in answer to his remarks, except acknowledging his appreciation of something having been done to help others on this most important subject.

Mr. Briggs remarked that a seasonal variation of load was not an unmixed evil; in my opinion it depends on the amount of variation, and certainly the levelling of the load curve in Macclesfield has been an all-round success. On reference to the tables given it will be seen that the summer increase is slightly greater in quantity than in the winter. The question raised on the allocation of costs for incidentals, such as cookers, fires, &c., is accounted for in the balance-sheets, and the table submitted is, as stated, only a summary of costs, and no matter how the cost is apportioned the reflection is shown in the final net profit for the year.

Mr. Shapley mentions that his undertaking could not face a 50 per cent. reduction in the summer. This would have been impossible at Macclesfield in one stage and it will be noted that we have arrived at our present position in three distinct steps, and it will be seen from the figures submitted that the better results obtained after the first year enabled us to make further reductions.

The contribution of Mr. Haynes to the discussion I greatly appreciate inasmuch as he has had a good deal of experience with a Two-Part Tariff System. His reference to the application of his " Rotherham " formula to the figures shown in Table V. is very interesting, and goes to prove there are more ways than one in arriving at the results required. He gives the results of the number of his consumers who have adopted his Scheme of Two-Part Tariffs, and I am sure he is very satisfied; but being only a small percentage of the whole it would be very interesting to know the effect on the whole of his domestic consumption. This was one of the main points I submitted, and, therefore, if the effect on the whole is not great I contend that the adoption of a Two-Part Tariff System fails in the aggregate.

I agree with Mr. Holton in that a seasonal charge has a far greater beneficial effect upon the domestic consumer whose demand is elastic, rather than upon the industrial consumer. He brings out one of the points in the Paper in stating that the industrial load is comparatively small in Macclesfield. Providing there is an opportunity of getting an industrial load, I agree that to increase in this direction is the best way for the equalization of the load factor, but if there is no possibility of industrial load, other means must be devised to try to attain a similar result.

Mr. Holton gives figures showing how a more balanced load has been accomplished in Manchester, but he explains that the levelling up illustrated was due to the fact that the lighting load was being lost. If the consumption is decreasing more in the winter than the summer, this in itself will show a more balanced load.

His suggestions for fixing charges to cover all circumstances would bring about complications and cause dissension among consumers whose main consideration is the total of their inclusive charge.

In Mr. Clegg's written communication here again we have a system more applicable to industry and commerce rather than domestic; in the scale of charges shown the majority of domestic consumers will never attain the consumption to qualify on the lower prices, and particularly in the case of prepayment consumers, the second stage being too great. The increase shown of 14 per cent. is comparable with our 62·7 per cent.; also there is not the equalization of the loads in summer and winter. From Mr. Clegg's experience he proves the necessity of multipart tariffs as applied to industrial and commercial business, but states that a two-part optional tariff scheme for domestic consumers has not been successful; this experience amplifies my point in that very few domestic consumers are willing to adopt any scheme with a definite standing charge.

Replying in general, the speakers who have spoken against seasonal charging are mainly representative of undertakings with a large industrial load, in which case I consider that a two-part tariff is the correct method, but in the case of Macclesfield the field for industrial consumption is very limited; in these cases Mr. Ridley and others admit the shortcomings of a two-part tariff. Further, I am of the opinion that the adoption of a two-part tariff scheme (domestic) will tend to make the summer and winter loads more divergent. (See Table VII.—A & B.)

A number of speakers lay stress on the fact that the Differential Charging Scheme has not fulfilled the expectations of equalizing the summer and winter loads. I maintain that our expectations have been amply realized in respect to the summer load, but owing to the consumer becoming " gas minded " there has also been an increased load in the winter. Mr. Haynes laid stress upon these latter points in his remarks, and states that if these conditions are to be construed as failure then there is little hope for the Gas Industry.

In our Differential Charging Scheme the whole of the consumers are automatically classified into three separate classes:—

1. The consumer who has a regular consumption over the whole year, gets his gas at an average rate.
2. The consumer who only uses gas in the winter pays a higher rate, and thereby pays a higher " demand " charge.
3. The consumer who uses gas only on the undertaking's Minimum Demand Period, thereby increasing the load factor, gets his gas at a cheaper rate.

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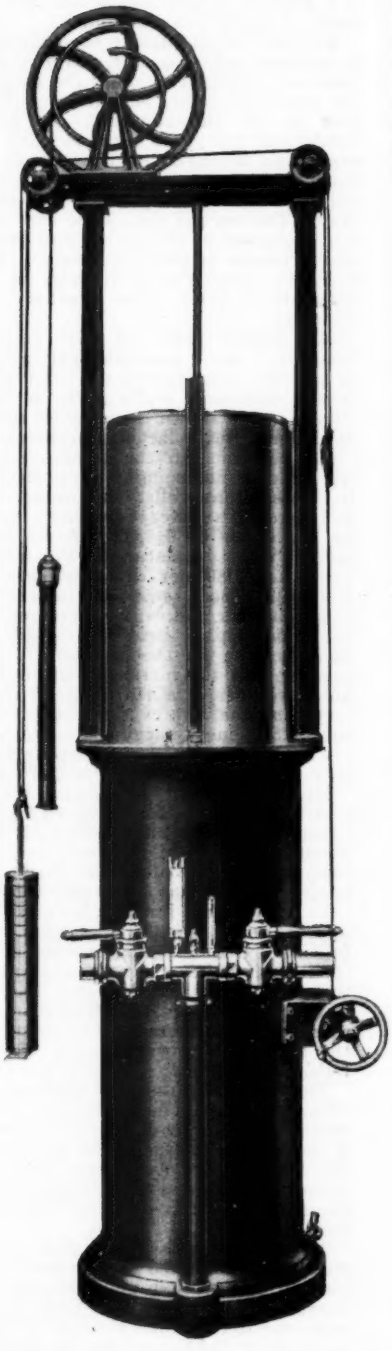

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Modernizing Small Gas Undertakings

By D. B. PARKINSON, M.A.,

Engineer at Chief Office, The British Gas Light Company, Ltd.

Mr. A. E. WHITCHER (Haywards Heath) wrote: In view of the fact that it is apparently becoming the rule instead of the exception for all the smaller gas undertakings to be eventually taken under the wings of larger concerns, it may be an opportune time for considering in what manner the problem of disposal of ammoniacal liquor and effluents on various works can be tackled.

Small works should eventually derive considerable advantage from the advice of the technical staff which would be at their disposal. The writer has for many years been endeavouring to solve this problem and has patented a plant which is effectively dealing with the quantity that can be passed through, but as the amount produced is in such a large volume, at present it is only partly solving the problem. This plant is only in its preliminary stages and reliable results are not yet available though it is in a considerable measure achieving the objects for which it is designed. Further experiments are in progress which may produce an improved plant of adequate capacity to solve the problem.

The steaming of horizontal retorts is another consideration that might, with advantage, be considered for smaller works where the gas produced is of too high a calorific value at certain periods. Reference was made to this at the recent meeting of the Wales and Monmouthshire Association of Gas Engineers and Managers in a speech by Mr. H. D. Madden, at the conclusion of which he referred to a patent taken out by Mr. H. King-Hiller with which the writer was also associated.

Mr. D. B. PARKINSON, replying, wrote: In reply to Colonel Carr's question concerning the Congdon system at King's Lynn, he is quite right in assuming that the temperature of the liquor at the well is 120° F., but the temperature at the bottom of the Congdon stand-pipes is only 160° F.

With regard to the free ammonia escaping from the well, this was at first somewhat of a nuisance, but the difficulty has been overcome by fitting a ventilator pipe and covering the openings in the well.

With reference to the dilution at Fenny Stratford, it should be mentioned that the figures shown in Table III. are for purified gas, whereas those given by Colonel Carr are for unpurified; also the calorific value of the outlet gas at Fenny Stratford was 470 B.Th.U. against 508 B.Th.U. at Stretford, and the proportion of producer gas was consequently greater. This would largely account for the high nitrogen figure, although the rather old beds and the addition of a small proportion of air for purification purposes would be contributing factors. For this reason also the percentage of hydrogen is lower than at Stretford, but at the same time it should be noted that the methane at Fenny Stratford is higher.

In answer to Mr. Thorman, it is difficult to say in the case of King's Lynn how much of the improvement in results was due to the Congdon system, since there was a complete change of the type of carbonizing plant. It may be possible later on to get a fairer comparison at our Trowbridge Works, when new settings, similar in every respect to existing ones, are fitted with Congdon pipes. The absence of hydraulic mains with dip pipes and varying seals and the elimination of stopped pipes makes it alone worth while, but the fact that the retorts are worked at practically level gauge, thus avoiding the infiltration of air or waste gases, must tend to higher thermal yield. At one works we had anti-dips in use, but the beds were very old and the conditions so unsatisfactory as to preclude any opinion as to their merits.

With regard to unsealed working at Fenny Stratford, no difficulty has been experienced with pressure when charging, and the governor is not altered when the retorts are opened.

Our estimation of the proportion of coal gas and producer gas is as follows:

—	Coal Gas.	Producer Gas.	Mixed Gas.
1	2	3	4
Make per ton . .	11,600	3,800	15,400
Calorific value . .	585	120	470
Therms	67·8	4·5	72·3

The extra fuel consumed in the producer is estimated at about 0·3 cwt. per ton, and the extra therms produced 4·5. Under ideal conditions the extra therms would theoretically be 5·2.

Replying to Mr. R. J. Restall, we have linked undertakings before commencing alterations to plant, when the holder accommodation has been limited and it has been necessary to dismantle some of the existing beds of retorts at one works to make room for new plant. The works eventually to be shut down has thus been able to take up some of the extra load during the period of reconstruction.

With reference to the flexibility of the Jenkins' Klönne I.V.C. ovens, Westgate and Birchington are seaside towns and the summer and winter loads are much the same. The maximum day in the summer is approximately 327,000 cu.ft. and the winter 376,000 cu.ft. We have however had no difficulty in dealing with loads varying from 181,000 to 376,000 cu.ft. No trouble has been experienced with keeping the calorific value constant.

When the Baldock installation was erected, Congdon pipes had not been brought particularly to our notice, but if we were putting up the plant again, we should seriously consider them, although we have had no bother with stopped pipes at this works.

At King's Lynn, coke cutting and screening plant was installed some time after the carbonizing plant. The hoppers can be seen in Plate 8 of the Paper.

There are a number of factors contributing to the greater saving in cost of gas into holder at Westgate over King's Lynn, but chiefly because at Westgate there was a greater reduction in labour and there was a more marked difference in results between the old and new plants using Kent coal than at King's Lynn with Yorkshire coal.

Mr. W. Clark Jackson and Mr. Toogood both referred to waste heat boilers. We have these in use at some works, but at the smaller places hand-fired Cornish or vertical boilers have the advantage of requiring little attention and maintenance and of holding a good reserve of steam.

With regard to continuous vertical retorts, the author is fully aware of the useful function of this type of plant for small works, as mentioned on page 6 of the Paper. Continuous verticals have not recently been erected in the works of the British Gas Light Company.

Legal Intelligence

Foreign Coins Allowed in Slot Meters.

Basingstoke Gas Company Criticized.

That the Company allowed consumers to use foreign silver coins in their prepayment gas meters in cases of emergency was admitted, under cross-examination, by Mr. H. C. Higgs, Managing Director and Secretary of the Basingstoke Gas Company, and was the subject of criticism by the Local Bench on June 26, when Thomas Cook, a boarding-house keeper, was charged with uttering counterfeit coins and stealing gas to the value of 23s.

Evidence was given that when the slot meter at his house was opened it was found to contain twenty-three halfpennies filed to the size of a shilling. Cook said he was a heavy consumer of gas, and if small consumers were allowed the privilege of using foreign silver coins he ought to be allowed greater privileges. He had always paid in genuine money the value represented by the filed coins in the meter.

He was fined £5 for uttering, and the charge for stealing was dismissed, the Magistrates observing that the Company was to blame for permitting foreign coins to be used.

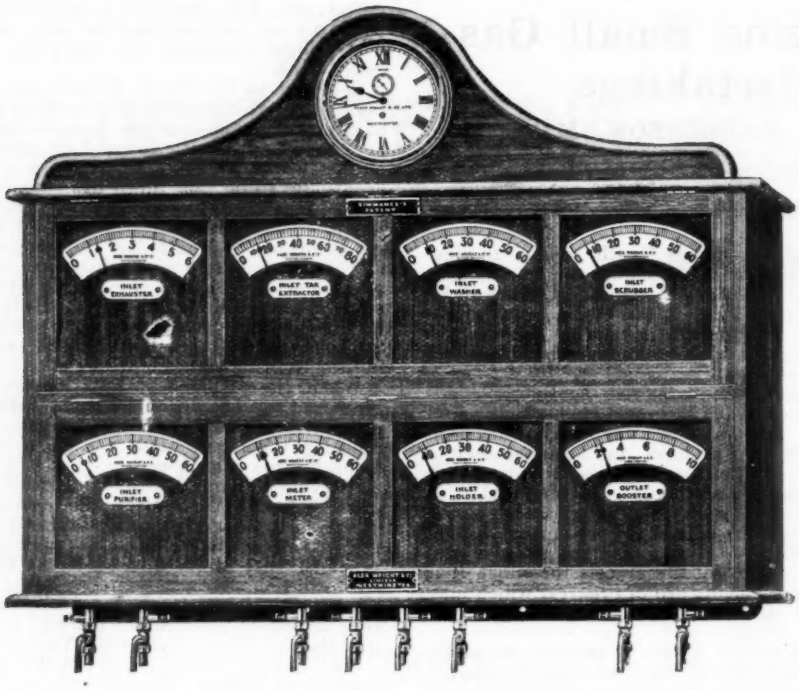
Trade Notes.

Progas Company, Ltd.

The showroom and offices of the Progas Company, Ltd., have been transferred to 121, Victoria Street, S.W. 1.

New Bye-Product Coking Plant for Harworth Colliery.

Messrs. Barber, Walker, & Co., Ltd., have placed an order with Simon-Carves, Ltd., of Cheadle Heath, near Manchester, for a battery of 30 of the latest type of coke ovens, with all necessary machinery, and a complete bye-product plant, coal-handling, draining, and blending plant. The new plant is to be built at the Company's Harworth Colliery, Bawtry, Yorkshire, on a virgin site. The ovens will be of the well-known twin-flue "Underjet" type, similar to those now being built by Simon-Carves, Ltd., for the Grassmoor Company, Ltd., Chesterfield, and the Dalton Main Collieries, Ltd., Rotherham.



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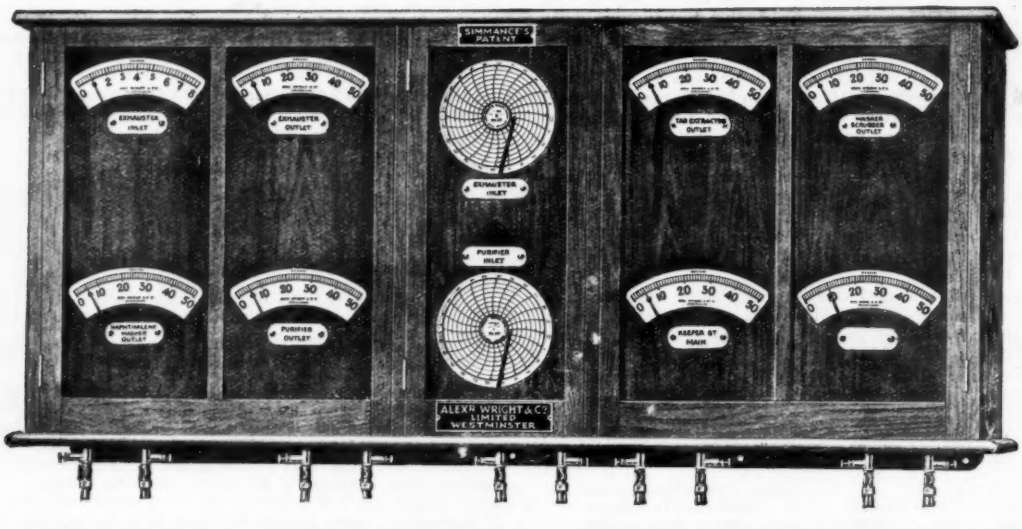
Note : **Dead-Beat instruments do not use liquids of any kind; there are no delicate or fragile parts, and the metal diaphragms withstand action of foul gas for many years. They respond instantly to slightest variation in vacuum or pressure, and there is no backlash.**



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GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

Influenced by the Chancellor of the Exchequer's optimistic review of the national finances, the heavy buying of British Government securities was again one of the chief features of Stock Exchange affairs last week, and several stocks touched new high records. As an indication of the strength of the present position, it is interesting to note that the 3½% War Loan at its present price of 103¼ stands higher than the 5% War Loan prior to its conversion to a 3½ p.ct. basis two years ago. The stimulus given to this section was also reflected in the Industrial market, the values of leading shares showing considerable improvements, while shipping, iron, coal, and steel shares also participated in the upward movement.

The large volume of business in the sections referred to above somewhat overshadowed the Gas market last week, and transactions were on a reduced scale. Prices, however, continued firm, and it will be seen in the Stock and Share List that several further improvements were recorded. Northampton 5% maximum and Plymouth and Stonehouse ordinary headed the list with gains of 3 each to 105½ and 169½ respectively. Even at this new price the Northampton stock, compared with other 5% maximum stocks, still appears to be somewhat undervalued, the yield working out at nearly 4¾%. The stock, however, is closely held and not frequently obtainable, and, as is the case with many other gas stocks, the absence of business over a long period militates against any improvement in the quotation. Among other increases were South Metropolitan, South Suburban, and Tottenham ordinaries, while, with the exception of the usual *ex* interest reductions, there were no falls in values.

The confidence in the Gas market is well illustrated by a comparison of current values with those ruling a year ago, as shown in the table below; and in this connection it may be well to point out that if British Government credit continues to improve at its present rate there will doubtless be some further advancement in the values of gas securities, particularly in the debenture class.

Ordinary Stocks.

—	Dividends. 1933 and 1934.	Middle Market Price.		Increase over 1933.
		July 1, 1933.	June 29, 1934.	
	%			
Bournemouth 7% max.	7	159½	167½	8
Brighton 5% con.	6¾	144½	153½	9
Bristol 5% max.	5	110½	119	8½
British	7½	149½	157½	8
Cardiff	6	121½	130½	9
Commercial	5¾	114½	122½	8
Croydon sliding-scale	7	147½	156½	9
Derby	8½	155	177½	22½
Gas Light units	£5 12s.	26s.	27s. 1½d.	1s. 1½d.
Imperial Continental	12	205	210½	5½
Liverpool	6	126	133	7
Newcastle	£5 7s. 6d.	25s.	25s. 7½d.	7½d.
Sheffield	6	126	140	14
South Metropolitan	6	125½	135½	10
South Suburban	6	126½	132½	6
Tottenham	6¾	144½	153½	9
Wandsworth	7	147½	159½	12

(Correction from Official List.—In last week's Stock and Share List the business done in South Metropolitan ordinary should have been marked 136, not 139.)

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *July* 2.

There are no changes to report in the tar products market.

Pitch continues steady at 58s. to 60s. per ton f.o.b.

Creosote is not less than 4d. per gallon.

Refined tar is 4d. to 4½d. per gallon in bulk at makers' works.

Pure toluole is 2s. 4d. to 2s. 5d.; pure benzole, 1s. 9d. to 1s. 10d.; 95/160 solvent naphtha, 1s. 7d. to 1s. 8d.; and 90/160 pyridine, 7s. to 7s. 6d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

July 2.

The average prices of gas-works products during the week were: Gas-works tar, 25s. to 30s.; Pitch—East Coast, 55s. to 57s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 55s. to 57s. 6d.* Toluole, naked, North, 1s. 11d. to 2s. Coal-tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 5½d. to 1s. 6d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 3¼d. to 3½d.; low gravity, 3¼d. to 3½d.; Scotland, 3⅛d. to 3⅜d. Heavy oils, in bulk, North, 3¾d. to 4¼d. Carbolic acid, 60's, 2s. to 2s. 1½d. Naphthalene, £10 to £11. Salts, 55s. to 75s.. bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *June* 30.

Market is distinctly quiet, with prices, if anything, a little easier.

Crude gas-works tar.—The actual value is 35s. to 37s. per ton *ex* works.

Pitch.—Export value is called 45s. per ton f.o.b. Glasgow. For home trade 42s. 6d. per ton *ex* works is quoted for reasonable quantities.

Refined tar is leaving the works in large quantities, and the value is unchanged at 3d. to 3¼d. per gallon *ex* works naked, according to quantity.

Creosote oil.—Demand is on a large scale and production is well looked after. B.E.S.A. specification oil is 4d. to 4¼d. per gallon; low gravity, 4½d. to 4⅝d. per gallon; and neutral oil, 4¼d. to 4½d. per gallon—all f.o.r. in bulk.

Cresylic acid.—Quotations show no alteration during the week. Pale, 97/99%, is 1s. 2½d. to 1s. 3½d. per gallon; dark, 97/99%, 1s. to 1s. 1d. per gallon; pale, 99/100%, 1s. 4d. to 1s. 5d. per gallon —all f.o.r. in buyers' packages.

Crude naphtha.—Price is steady at 4¾d. to 5¼d. per gallon, according to quality and quantity.

Solvent naphtha.—90/160 grade is 1s. 4d. to 1s. 4½d. per gallon, and 90/190 grade is 8d. per gallon.

Motor benzole is purely nominal at 1s. 5d. to 1s. 6d. per gallon *ex* works.

Pyridines—90/160 grade is 5s. 6d. to 6s. per gallon, and 90/140 grade is 6s. 6d. to 7s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.		
Crude benzole	0	9	to	0	9½	per gallon at works	
Motor "	1	3½	"	1	4	"	"
90% "	1	4	"	1	4½	"	"
Pure "	1	7½	"	1	8	"	"

Contracts Advertised To-Day.

Coal.

Haverhill (Suffolk) Gas Department. [p. 58.]

Painting, &c.

Blackpool Gas Department. [p. 60.]

Pipes and Specials.

Blackpool Gas Department. [p. 60.]

Retorts.

Bexhill Gas Department. [p. 60.]

Wagons, Hire of

Stockport Gas Department. [p. 60.]

Wood Troughing.

Blackpool Gas Department. [p. 60.]

New Capital Issues.

Watford and St. Albans Gas Company.—As will be seen from our advertisement columns, the Watford and St. Albans Gas Company are issuing £113,564 5% preference stock and £50,000 4% redeemable debenture stock, 1963. The preference stock is to be issued at a minimum price of £123 10s. per £100 stock, and the debenture stock at £104 per £100. The last day for the receipt of tenders is July 16. The extra capital is mainly necessitated by the rapid developments of the Company's business, and the proposed issue will bring the amount of the issued share and loan capital of the Company to over £1,400,000.

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•

GLOVER - WEST

CONTINUOUS VERTICAL RETORTS

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WEST VERTICAL

SEMI-INTERMITTENT CHAMBERS

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WEST

FUEL-HANDLING & GRADING PLANT

Copies of our publications, "Results in Glover-West Vertical Retorts," "Features of the Glover-West System," "Steaming in Vertical Retorts," and "The West Lip-bucket Conveyor" will gladly be sent on request.

Designed, Manufactured, and Erected by

WEST'S GAS IMPROVEMENT COMPANY, LTD.

MILES PLATTING, MANCHESTER 10

TELEPHONE : COLLYHURST 2961 (4 LINES)

TELEGRAMS : STOKER MANCHESTER

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. June 29.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Apl. 9	7	7	Alliance & Dublin Ord. ...	128—138	...	135½—138
374,000	"	June 25	4	4	Do. 4 p c. Deb. ...	90—100*	...	...
557,655	"	Mar. 5	7	7	Barnet Ord. 7 p.c.	167—172	...	...
900,000	1	May 7	1/4⅛	1/9⅜	Bombay, Ltd.	27/6—29/6	...	...
178,480	Stk.	Feb. 19	9½	9½	Bournemouth sliding scale	203—208	...	...
550,050	"	"	7	7	Do. 7 p.c. max. ...	165—170	...	170
489,160	"	"	6	6	Do. 6 p.c. Pref. ...	142—147	...	...
50,000	"	June 11	3	3	Do. 3 p.c. Deb. ...	78—83	...	...
262,025	"	"	4	4	Do. 4 p.c. Deb. ...	103—108	...	107½
335,000	"	"	5	5	Do. 5 p.c. Deb. ...	119—124	...	...
357,900	"	Mar. 5	7½	7½	Brighton, &c., 6 p.c. Con. ...	161—166	...	...
540,000	"	"	6¾	6¾	Do. 5 p.c. Con. ...	151—156	...	...
196,500	"	"	6	6	Do. 6 p.c. B. Pref.	140—145	...	...
1,487,500	"	Mar. 5	5	5	Bristol 5 p.c. max.	118—120a	...	...
130,420	"	June 11	4	4	Do. 1st 4 p.c. Deb. ...	102—105a	...	...
217,870	"	"	4	4	Do. 2nd 4 p.c. Deb. ...	102—105a	...	...
338,790	"	"	5	5	Do. 5 p.c. Deb.	121—123a	...	...
885,000	"	Apl. 9	7	8	British Ord.	156—160	...	158—159
100,000	"	June 11	7	7	Do. 7 p.c. Pref.	151—156	...	158
350,000	"	"	5½	5½	Do. 5½ p.c. Pref.	104—109	...	...
120,000	"	"	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	"	"	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...	...
160,000	"	June 11	5	5	Cambridge 5 p.c. Deb. ...	115—120	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	2—4	+½	...
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	5—7	...	...
150,000	Stk.	June 25	4½	4½	Do. 4½ p.c. Deb. ...	93—98*	−2	96½
626,860	"	Feb. 19	6	6	Cardiff Con. Ord.	128—133	...	...
237,860	"	June 11	5	5	Do. 5 p.c. Red. Deb.	103—108	...	...
157,150	"	Feb. 19	5	6½	Chester 5 p.c. Ord.	112½—122½b	...	...
98,936	1	May 7	2/-	2/-	Colombo, Ltd.	1⅞—1⅛	...	35/6
24,500	1	"	1/4⅛	1/4⅛	Do. 7 p.c. Pref. ...	18/6—20/6	...	...
609,204	1	Mar. 19	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	19/6—21/6	...	...
296,053	1	"	1/8'30	1/8'30	Do. 8 p.c. Pref.	23/6—25/6	...	...
1,775,005	Stk.	Feb. 19	5	6½	Commercial Ord.	120—125	...	120—121½
475,000	"	June 11	3	3	Do. 3 p.c. Deb. ...	78—83	+2	...
286,344	"	Mar. 5	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
807,560	"	Feb. 19	7	7	Croydon sliding scale ...	154—159	...	155
569,590	"	"	5 -	5	Do. max. div.	105—110	...	...
620,385	"	June 25	5	5	Do. 5 p.c. Deb.... ...	119—124*	−2	...
542,270	"	Mar. 5	7	10	Derby Con.	175—180e	...	...
55,000	"	June 25	4	4	Do. 4 p.c. Deb.	97—100e*	−½	...
209,000	"	Feb. 19	5	5	East Hull Ord. 5 p.c. ...	106—111	...	...
181,625	"	Mar. 5	6	6	East Surrey Ord. 5 p.c. ...	126—131	...	...
175,809	"	June 11	5	5	Do. 5 p.c. Deb. ...	116—121	...	...
1,002,180	"	Apl. 9	†5	†7	European, Ltd.	121—124	...	123½—124½
19,342,763	"	Feb. 19	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	26/10½ 27/4½f	...	26/10½—27/3
2,600,000	"	"	3½	3½	Do. 3½ p.c. max. ...	87 90	...	88—88½
4,477,106	"	"	4	4	Do. 4 p.c. Con. Pref. ...	104 - 107	...	106½—107
6,102,497	"	May 28	3	3	Do. 3 p.c. Con. Deb. ...	84 - 87	...	86½—86½
3,642,770	"	"	5	5	Do. 5 p.c. Red. Deb. ...	115—118	...	117⅜—118
2,500,000	"	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	113—116	...	...
270,466	"	Mar. 5	6	6	Harrogate New Cons. ...	125—130	...	...
82,500	"	Mar. 5	7	7	Hastings & St. L. 5 p.c. Conv.	147—152	...	...
258,740	"	"	5½	5½	Do. 3½ p.c. Conv	117—122	...	...
140,000	1	Apl. 23	1/7½	1/7½	Hongkong & China, Ltd. ...	1⅝—1⅞	...	...
213,200	Stk.	Mar. 5	6	6	Hornsey Con. 3½ p.c. ...	128—133	...	...
5,600,000	"	May 28	10	14	Imperial Continental Cap.	208—213	+1	209—212
223,180	"	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	89—94	...	...
285,249	"	Mar. 5	8½	8½	Lea Bridge 5 p.c. Ord. ...	169—174	...	...
2,167,410	"	Mar. 5	6	6	Liverpool 5 p.c. Ord. ...	132—134b	...	...
245,500	"	June 11	5	5	Do 5 p.c. Red. Pref. ...	101—111b	...	...
306,083	"	Jan. 15	4	4	Do. 4 p.c. Deb. ...	101½—103½b	...	...
165,786	"	Feb. 19	8	10	Maidstone 5 p c. Cap. ...	180 -190	...	...
56,176	"	June 25	3	3	Do. 3 p.c. Deb. ...	71—76*	−1	...
75,000	5	May 28	†10	†10	Malta & Mediterranean ... Metropolitan (of Melbourne)	...	...	...
392,000	—	Apl. 3	5½	5½	5½ p.c. Red. Deb.	98 -103	...	...
231,978	Stk.	Feb. 19	5	5	M. S. Utility "C." Cons. ...	113—118	...	...
818,657	"	"	4	4	Do. 4 p.c. Cons. Pref.	95—100	...	...
360,075	"	June 11	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
148,955	"	"	5	†5	Do. 5 p.c. Deb. ...	118—123	...	...
675,000	"	May 28	†6	†13	Montevideo, Ltd.	60—65	...	...
2,061,315	"	Mar. 5	5	5½	Newcastle & Gateshead Con.	25/3—26/-d/	—	...
682,886	"	"	4	4	Do. 4 p.c. Pref. ...	99—101d	...	...
776,706	"	June 11	3½	3½	Do. 3½ p.c. Deb. ...	90½—91½d	...	...
277,285	"	May 7	5	5	Do. 5 p.c. Deb. '43 ...	105—107d	...	...
274,000	"	Feb. 19	5	5	Newport (Mon.) 5 p.c. max.	106—10⅞a	...	...
204,940	"	Mar. 19	7½	7½	North Middlesex 6 p c. Con.	155—160	...	...
396,150	"	Feb. 5	5	5	Northampton 5 p.c. max. ...	103 - 108	+3	...
300,000	"	May 7	†9	†7	Oriental, Ltd.	155—160	...	...
416,617	"	June 11	8	8	Plym'th & Stonehouse 5 p.c.	167—172	+3	170—172
504,416	"	Feb. 19	8	8	Portsm'th Con. Stk. 4 p.c. Std	168—173	...	...
241,446	"	"	5	5	Do. 5 p.c. max. ...	105—110	...	...
114,000	"	Feb. 19	5	5	Preston 5 p.c. Pref.	103—108	...	...
686,312	"	Jan. 22	4	4	Primitiva 4 p.c. Rd. Pb. 1911	87—92	...	...
389,813	"	June 25	4	4	Do. 4 p.c. Cons. Deb.	87—92*	−1	...
150,000	10	Mar. 19	6	6	San Paulo 6 p.c. Pref. ...	7—8	...	...
1,736,968	Stk.	Mar. 19	6	6	Sheffield Cons.	139—141e*	+1	...
95,000	"	Jan. 8	4	4	Do. 4 p.c. Deb.	101—103e	...	...
133,201	"	Feb. 19	8½	5	Shrewsbury 5 p.c. Ord. ...	135—140	...	...
90,000	10	May 28	†4	†3	South African	2—4	...	...
6,709,895	Stk.	Feb. 19	5	7	South Met. Ord.	134—137	+1½	135—136½
1,135,812	"	"	6	6	Do. 6 p c. Irred. Pf.	140—145	...	143½—144½
850,000	"	"	4	4	Do. 4 p.c. Irred. Pf.	103—107	...	...
1,895,445	"	June 25	3	3	Do. 3 p.c. Deb. ...	83—86*	−1	85½—£85/16/9
1 000,000	"	Jan. 22	5	5	Do. 5 p.c. Red. Deb.	114—117	...	...
209,880	"	Mar. 5	8½	8½	South Shields Con.	166—168d	...	...
1,543,795	"	Feb. 19	6	6	South Suburban Ord. 5 p.c.	131—134	+1	131½ 132
512,825	"	"	5	5	Do. 5 p.c. Pref.	118—123	...	...
300,000	"	"	—	4	Do. 4 p.c. Pref.	103—108	...	...
868,837	"	June 11	5	5	Do. 5 p.c. Deb.	120—125	+1	...
100,000	"	"	4	4	Do. 4 p c. Deb.	102—107	...	...
647,740	"	Mar. 5	5	5	Southampt'n Ord. 5 p.c. max.	110—115	...	...
121,275	"	June 11	4	4	Do. 4 p c. Deb.	99—104	...	...
350,000	"	Mar. 5	5½	5½	Swansea 5½ p.c. Red. Pref.	107—112	...	...
200,000	"	June 11	6½	6½	Do. 6½ p c. Red. Deb.	100—105	...	...
1,076,490	"	Mar 5	6½	6½	Tottenham and District Ord.	151—156	+1	154—156
409,835	"	"	5½	5½	Do. 5½ p.c. Pref. ..	126—131	...	...
62,235	"	"	5	5	Do. 5 p.c. Pref. ...	115 - 120	...	...
199,005	"	June 11	4	4	Do. 4 p.c. Deb. ...	98 -103	...	...
85,701	"	Apl. 9	6	6	Tuscan, Ltd. 6 p c. Red. Db.	90—100	...	...
349,110	"	Mar. 5	7	7	Uxbridge, &c., 5 p.c. ...	150—155	...	...
88,330	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
1,322,220	"	Mar. 5	7	7	Wandsworth Consolidated	157—162	...	157 162
1,096,378	"	"	5	5	Do. 5 p.c. Pref.	119—124	...	123—123½
1,317,964	"	June 11	5	5	Do. 5 p.c. Deb.	120—125	...	...
158,400	"	Mar. 5	5	6g	Winchester W.& G. 5 p.c. Con	115—120	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—Paid £3, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

STOCK FOR SALE BY TENDER.

THE WATFORD & ST. ALBANS GAS COMPANY.

SALE BY TENDER OF

£50,000

4% Redeemable Debenture Stock, 1963,

At a minimum price of £104 per £100 Stock, yielding at that price £3 16s. 11d. per cent.

£113,564

5% Preference Stock

At a minimum price of £123 10s. 0d. per £100 Stock, yielding at that price £4 1s. 0d. per cent.

Tenders to be sent to the Company's Chief Offices, not later than noon on Monday, 16th July, 1934.

Balance of purchase money payable by 31st July, 1934.

(Messrs. Angel H. Hart & Co., Brokers to the Issue, have guaranteed to procure Tenders at the minimum price for the whole of the Issue for a commission of 1¼%.)

PARTICULARS OF SALE AND TENDER FORMS will be available from 2nd July, 1934, and may be obtained from the Company's Offices or Showrooms, or from Lloyds Bank, Ltd., Watford, and all local branches.

By Order of the Board,
GEORGE WILKS,
Secretary and Commercial Manager.

Chief Offices,
Gas-Works, Watford,
29th June, 1934.

COMPANY NOTICES.

SOUTH SUBURBAN GAS COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS relating to the ORDINARY and PREFERENCE STOCKS of this Company WILL BE CLOSED from the 14th July to 27th July, both days inclusive.

By order of the Board,
T. BROWN,
Secretary.

Head Office,
Lower Sydenham, S.E. 26,
June 30, 1934.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company, SO FAR AS THEY RELATE TO ORDINARY STOCK, WILL BE CLOSED from the 9th July to 8th August, both days inclusive.

By order of the Board,
F. J. BRADFIELD,
General Manager and Secretary.

Offices,
Stepney, E. 1,
June 26, 1934.

OXIDE

CONSULT

THE BRITISH GAS PURIFYING MATERIALS CO., LTD.,
99, LONDON ROAD, LEICESTER.
Telegrams: "BRIPURIMAT, LEICESTER." Telephone: LEICESTER 59056.

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BRETTEL'S ESTATE
FIRE-CLAY & BRICK WORKS
STOURBRIDGE
Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST FURNACE BRICKS, LUMPS, TILES, and every Description of FIRE BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.
LONDON OFFICE: E. C. BROWN & Co., LEADENHALL CHAMBERS, 4, ST. MARY AXE, E.C.

A & M GAS-METERS

TRAIN·THE·THERMS

THERMSALLEFFICIENCY

Sergt. A. Ɛ. M. Meters is working at high pressure in the control of industrial therms. His conduct under heavy fire is exemplary. When *your* therms are in hot water enlist Sergt. A Ɛ. M. Meters to check them up. *He* has no missing list !

A. Ɛ. M.
LARGE STANDARD AND HIGH CAPACITY METERS

We make a full range of large meters for industrial gas measurement. Great care is taken in the construction of these to ensure strength and rigidity. Sizes 9 and 1200 cu.ft. High Capacity and upwards are fitted with flanged connections May we have your enquiries ?

ALDER & MACKAY LIMITED

MAKE METERS OF METICULOUS MEASUREMENT

ALDER & MACKAY LTD., EDINBURGH, LONDON & BRADFORD